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COMPLETED

FLOOD INSURANCE STUDY

NUECES COUNTY, TEXAS

UNINCORPORATED AREAS

JUNE 4, 1987

Federal Emergency Management Agency

COMMUNITY NUMBER - 485494

NOTICE TO
FLOOD INSURANCE STUDY USERS

This Flood Insurance Study was revised on June 4, 1987. Users should refer to the Revision Description section (Section 9.0) of this text for further information.

Part or all of this Flood Insurance Study may be revised at any time. The user is therefore cautioned that a published map revision (i.e., a revised Flood Insurance Rate Map) may not include a reprinting of the text, tables, and/or profiles, resulting in a discrepancy between the revised map and the original study components. It is the responsibility of the user to consult with community officials to obtain the most current Flood Insurance Study components.

Initial Flood Insurance Study Effective Date: September 27, 1972

Flood Insurance Study Revised: [illegible] 30, 1973
July 1, 1974
September 3, 1976
March 18, 1975
June 4, 1987

Communities participating in the National Flood Insurance Program (NFIP) have established repositories of flood hazard data for floodplain management and flood insurance purposes. This Flood Insurance Study (FIS) may not contain all data available within the repository. It is advisable to contact the community repository for any additional data.

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PUBLISHED SEPERATELY:

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Flood Insurance Rate Map

FLOOD INSURANCE STUDY
UNINCORPORATED AREAS OF NUECES COUNTY, TEXAS

1.0 INTRODUCTION

1.1 Purpose of Study

This Flood Insurance Study investigates the existence and severity of flood hazards in the unincorporated areas of Nueces County, Texas and aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. This study will be used to maintain the County to the regular program of flood insurance by the Federal Emergency Management Agency (FEMA). The county had been converted to the regular program on September 22, 1972. Local and regional planners will use this study in their efforts to promote sound flood plain management.

In some states or communities, flood plain management criteria or regulations may exist that are more restrictive or comprehensive than those on which these Federally-supported studies are based. These criteria take precedence over the minimum Federal criteria for purposes of regulating development in the flood plain, as set forth in the Code of Federal Regulations at 44 CFR, 60.3 (d&e). In such cases, however, it shall be understood that the state (or other jurisdictional agency) shall be able to explain these requirements and criteria.

1.2 Authority and Acknowledgments

The source of authority for this Flood Insurance Study is the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973.

The hydrologic and hydraulic analyses for this study were performed by Espey, Huston & Associates, Inc. for the Federal Emergency Management Agency, under Contract No. 4786. This study was completed in August 1983.

1.3 Coordination

A meeting held in Corpus Christi on May 3, 1978, was attended by officials of the county, a representative of FEMA, and a representative of Espey, Huston & Associates, Inc. The meeting was held to explain the nature and purpose of the study, the scope and limits of the work, and to obtain any available flood information relevant to the study.

The U.S. Geological Survey (USGS) district office in San Antonio was contacted on the availability of stream gaging stations within the study area. There are no stream gaging stations located on streams selected for study other than the Nueces River.

The U.S. Army Corps of Engineers (COE), Hydrology Division Office in Galveston, Texas, and the Texas Department of Water Resources in Austin, Texas were contacted to provide available flood information pertinent to the county, however, no flood data applicable to the study area was found other than the existing Flood Insurance Study (Reference 1).

The Texas Highway Department in Austin and the Soil Conservation Service (SCS) in Victoria and Temple, Texas were contacted to provide available information on flood control measures within the study area. All information pertinent to this study is included in this report.

On March 22, 1984, the results of the study were reviewed at the final meeting attended by representatives of the study contractor, FEMA and community officials. The study was acceptable to the community.

2.0 AREA STUDIED

2.1 Scope of Study

This Flood Insurance Study covers the unincorporated area of Nueces County, Texas. The area of study is shown on the Vicinity Map (Figure 1).

The study analysis includes coastline flooding due to hurricane-induced storm surge. Both the open coast surge and its inland propagation were studied; in addition, the added effects of wave heights were also considered.

The areas studied by detailed methods were selected with priority given to all known flood hazard areas, and areas of projected development or proposed construction within the next five years, through August 1988.

Approximate analyses were used to study those areas having a low development potential or minimal flood hazards. The scope and methods of study were proposed to an agreed upon by FEMA and Nueces County.

2.2 Community Description

Nueces County is located along the Texas Gulf Coast extending from the Nueces River and the western tip of St. Joseph Island to approximately 10 miles south of Corpus Christi Bay. The central portion of the county, near the county seat of Corpus Christi, is approximately 145 miles southeast of San Antonio and 210 miles southwest of Houston.

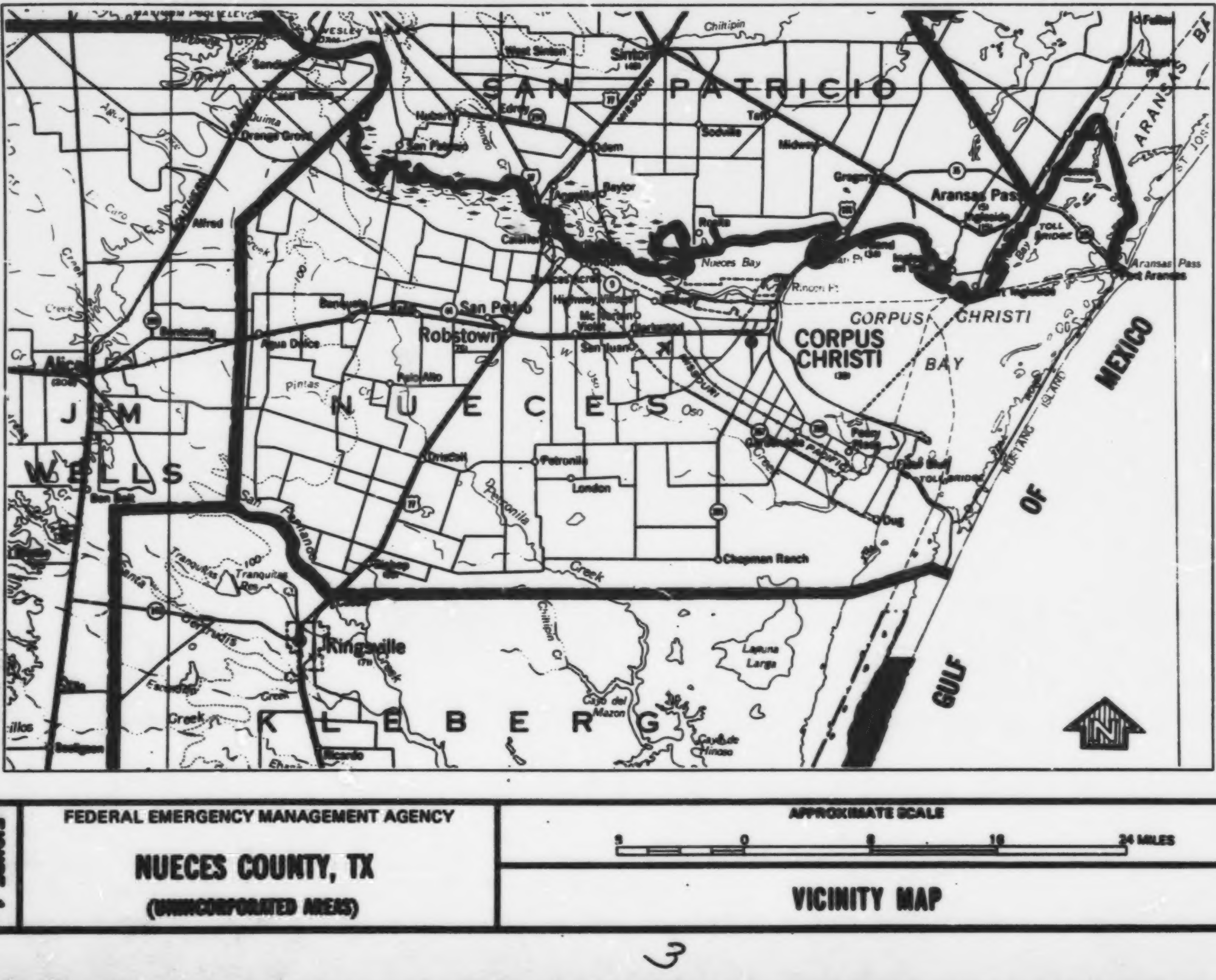

SAN PATRICIO
JIM WELLS
NUECES
KLEBERG
CORPUS CHRISTI
CORPUS CHRISTI BAY
GULF OF MEXICO
Nueces Bay
Aransas Pass
Port Aransas
Robstown
San Pedro
Alice
Kingsville
Sinton
Odem
Taft
Gregory
Portland
Sodville
Midway
Calallen
Annaville
Driscoll
Petronila
London
Chapman Ranch
Agua Dulce
Banquete
Bishop
Tranquitas
Laguna Larga
Rincon Pt.
Mustang Island
Oso
Chiltipin
Rockport
Fulton
Orange Grove
Alfred
San Juan
Highway Village
Ben Bolt
Ricardo
ARANSAS BAY
N

FIGURE 1

BEST COPY AVAILABLE

FEDERAL EMERGENCY MANAGEMENT AGENCY

NUECES COUNTY, TX

(UNINCORPORATED AREAS)

APPROXIMATE SCALE

8 0 8 16 24 MILES

VICINITY MAP

3

Nueces County was originally created from San Patricio County in 1846, and presently covers a total area of 1,120 square miles of which 835 are land. The county is largely drained by the Nueces River, feeding into Nueces and Corpus Christi Bays, and Petronila, San Fernando, and Oso Creeks. Nueces and Corpus Christi Bays are wholly within Nueces County and are protected from the open Gulf by Mustang Island, while Laguna Madre south of Corpus Christi Bay is shelterd by Padre Island. The total bay area within the county limits is 285 square miles.

The topography of Nueces County is generally flat with elevations ranging from sea level to 180 feet. The county lies within the Gulf Coast Prairies natural region where the predominant vegetation is prairie and tidal grasses and scattered stands of timber along the Nueces River. Average temperatures range from 47 to 97 degrees F, while the average annual rainfall is approximately 27 inches (Reference 2).

Between 1970 and 1978, Nueces County experienced a population growth of 4.9%, increasing from 237,544 persons in 1970 to 249,000 by 1978. Corpus Christi, the largest city in the county, exhibited a similar growth of 5.2% during this period with approximately 215,000 persons in 1977 and an estimated 12.0% growth over the entire decade with 230,000 persons in 1980. Based upon growth trends of the past two decades, Nueces County is projected to experience steady population gains in the foreseeable future (References 3 and 4).

2.3 Principal Flood Problems

Historical descriptions of past hurricanes and related damage are plentiful for this area. Figure 2, "Historical Storm Tracks (1900-1971)" show the tracks of some of the more significant storms to enter the Gulf of Mexico since 1900. Descriptions of the most significant storms follow.

1919 STORM (2-15 September). This storm was first noticed in the tropical storm stage in the extreme eastern portion of the Caribbean Sea. It was moving in a generally northwesterly direction toward the eastern portion of the Dominican Republic. From there it moved into the Atlantic Ocean before turning to a more westerly course, passed between the tip of Florida and Cuba, and entered the Gulf on a generally westerly course before striking the Texas coast in the vicinity of Baffin Bay. The eye of the storm moved inland over Kingsville and then turned west-northwestward towards Laredo.

Prior to Hurricane CARLA (1961) the 1919 STORM was considered the largest known hurricane to strike the Texas coast. Based on observations from various locations along the coast, the 1919 STORM mass had an unusually large diameter as did CARLA. Inadequate data for the 1919 STORM prevents conclusive comparisons between the big storms.

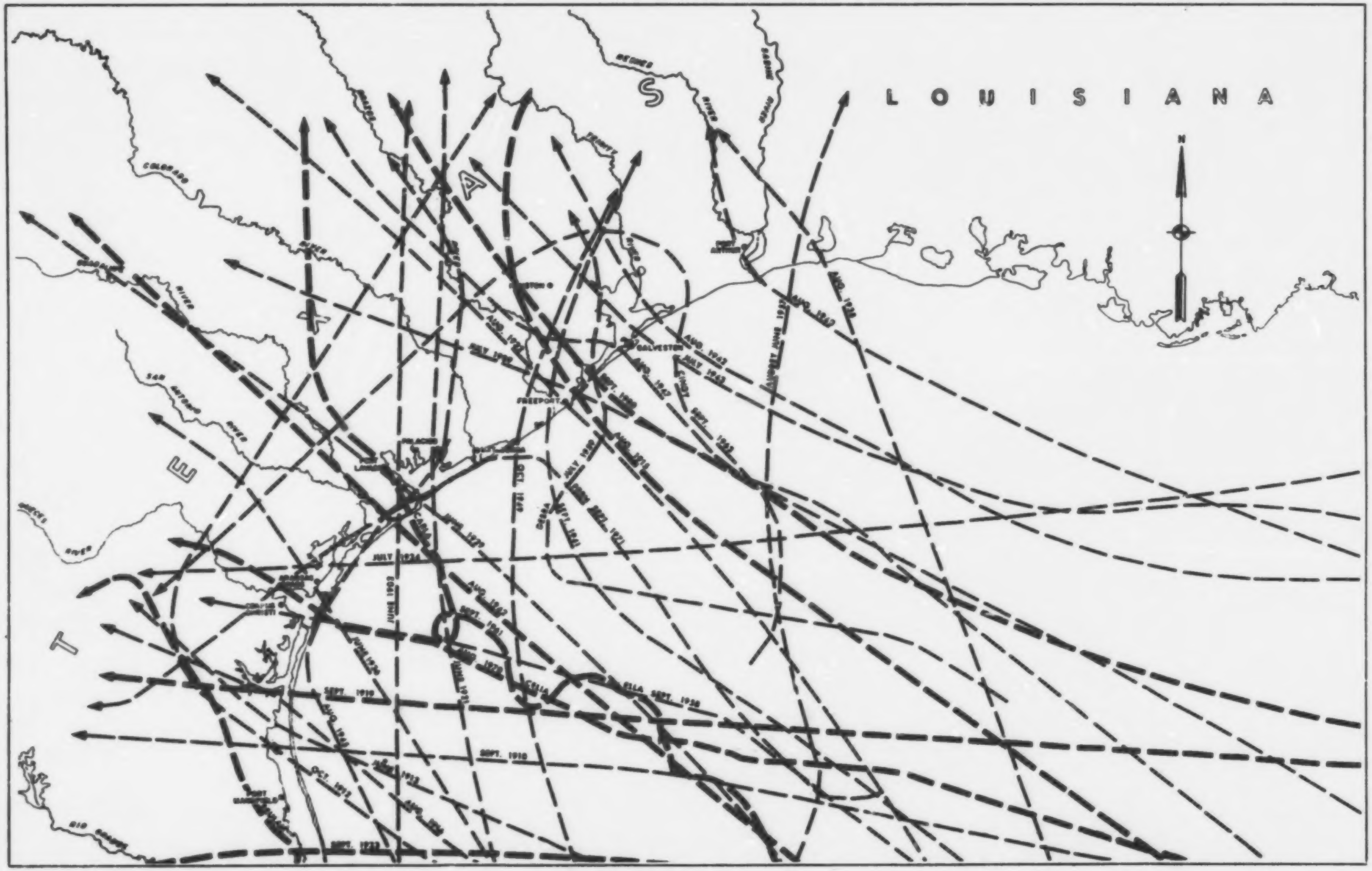

LOUISIANA
TEXAS
N
GALVESTON
FREEPORT
CORPUS CHRISTI
COLORADO RIVER
SAN ANTONIO RIVER
NUECES RIVER
RIO GRANDE
SABINE RIVER
NECHES RIVER
TRINITY RIVER
BRAZOS RIVER
CELIA
CARLA
BEULAH
ELLA SEPT. 1958
SEPT. 1919
SEPT. 1910
JULY 1934
AUG. 1942
SEPT. 1961
OCT. 1949

FIGURE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

NUECES COUNTY, TX

(UNINCORPORATED AREAS)

HISTORICAL STORM TRACKS (1900-1971)

Maximum sustained wind velocity recorded at Corpus Christi was 80 miles per hour. Surge elevations of up to sixteen feet were recorded as the storm surge swept across the barrier islands and through the passes, piling water upon the landward shores of Corpus Christi and Nueces Bays. Highest recorded surge elevations along the coast were approximately 11.1 feet. Surges of 6.6 feet or greater were experienced along almost the entire Texas coast.

The Town of Port Aransas on the north end of Mustang Island was entirely destroyed. The Corpus Christi Beach, or North Beach as it was known, was swept clean of all but three badly battered buildings. A section of Corpus Christi located below the 35-foot high bluff and having ground elevations ranging from four to seven feet was almost totally destroyed. This area was about three blocks wide and ten blocks long and contained warehouses, businesses, hotels, the electric power and light plant, two ice plants, and many residences. All of the development was totally destroyed except two one-story brick buildings, the upper floor and power plant of the six-story Nueces Hotel, and some machinery of the city power and light plant. The storm left 350 persons dead, and the damages exceeded $20 million.

1945 STORM (24-29 August). This storm originated in the Gulf of Mexico off the southern Mexican coast on 25 August. The storm moved in a northerly direction to within about forty miles of Port Isabel by August 25th and continued northward, skirting the Texas coast before moving inland in the vicinity of San Jose Island on the morning of August 26th. The storm continued to move northeastward along the coastal area, across Matagorda Bay, and then towards Bay City.

The storm was unusual in the coastal path it maintained and its slow forward movement (less than 5 mph), thereby raking essentially the entire Texas coast. The area between Port Aransas and the mouth of the Colorado River received the maximum force of the hurricane.

The maximum storm surge varied considerably along the coast with about three feet recorded at Port Isabel, 3.7 feet at Port Aransas, 3.2 feet at Port Lavaca, and 7.0 feet at Palacios. Maximum wind velocities were estimated at 76 mph at Port Isabel, 100 to 125 mph at Port Aransas, 85 mph at Palacios, and 135 mph at Seadrift, Oivia, Port O'Connor, and Port Lavaca.

The storm killed three people, injured 25, and caused damages exceeding $20 million.

Hurricane CELIA (30 July-5 August 1970). CELIA originated as a tropical depression in the northwestern Caribbean Sea on 30 July. The depression developed into a hurricane on August 1st after entering the Gulf Mexico. The relatively small storm mass moved moderately fast and eratically across the Gulf toward the Texas coast. CELIA lost strength on the morning of August 3rd as the storm rapidly increased in size, but as CELIA neared the coast, the eye of the storm became smaller and more concentrated and the wind speeds increased. When CELIA was located about thirty miles east-southeast of Corpus Christi, the storm had regained strength with highest winds estimated at 115 miles per hour. The storm continued to intensify as it moved inland across Mustang Island and into Corpus Christi Bay at a forward speed of 17 mph. The anemometer at the weather station in Aransas Pass was blown away after measuring wind gusts of 150 miles per hour. Subsequent peak gusts were estimated to have reached 180 miles per hour. Maximum gusts of 160 mph were recorded at the Corpus Christi National Weather Service Office.

The metropolitan area of Corpus Christi, the Cities of Robstown, Port Aransas, and Aransas Pass, and the small towns along Corpus Christi Bay suffered the most damage. Although considerable damage resulted from storm surge, the majority of the destruction resulted from high winds. A surge of 9.2 feet was recorded on the Gulf beach at Port Aransas, and a surge of 11.4 feet was recorded on the south side of Aransas Pass. At Corpus Christi, the stillwater surge elevation ranged from 3.9 to 5.6 feet.

CELIA was the costliest storm in the state's history, having caused an estimated total damage of $470 million. Wind damage accounted for $440 million of this total. There were 13 people killed and over 450 injured. More than 9,000 homes were destroyed, 14,000 others damaged and 250 businesses and 300 farm buildings were damaged or destroyed.

2.4 Flood Protection Measures

Numerous channels have been dredged throughout the study area, connecting coastal and inland communities with bay and Gulf shipping routes. The Gulf Intracoastal Waterway extending from Apalachee Bay, Florida to the Rio Grande at an approximate 12-foot depth is the most prominent waterway in the study area. The last link in the main channel was completed in 1949 with many tributary and feeder channels added in recent years. Other major channels within the study area include: Aransas Channel (project depth of 10 feet) and Corpus Christi Channel (project depth of 45 feet) serving the Aransas and Corpus Christi Bay areas, respectively.

Existing hurricane flood protection within the study area is limited to a few locally constructed seawalls and flood gates in the more populated urban areas, as well as several earthen and concrete dikes constructed by private industries. The northern portion of the City of Corpus Christi is protected to an elevation of 14 feet mean sea level (msl) an approximate 2-mile long concrete seawall constructed in 1942. Although Corpus Christi has not been severely threatened by a major hurricane since construction of the seawall, the structure has effectively minimized the effects of high tides associated with Hurricane Carala which made landfall farther up the coast, as well as with less intense storms in the Corpus Christi vicinity. In addition, flood gates have been installed at the harbor bridge and at several downtown locations to afford protection up to 14 ft msl.

A 2.5-mile long earthen seawall was constructed in the City of Aransas Pass in 1929. Composed of local dredged material, the levee ranges from 16 to 21 feet msl and extends along the waterfront of most of the developed portion of the city. The levee has prevented the community from being significantly inundated during past storms, although the structure was breached on the southeast side during Hurricane Celia causing minor tidal flooding.

Apart from these publicly financed flood protection works in Corpus Christi and Aransas Pass, various private industries near the coast have constructed levees. Refineries in the Corpus Christi area have constructed 6 to 10-ft high levees around storage tanks primarily to contain potential spills; however, these levees also afford protection against hurricane surge waters to some extent. Similarly, the Dupont Company and, to a lesser extent, Brown and Root in Aransas Pass have constructed 5 to 7-ft high earthen and concrete dikes around storage tanks and equipment areas. Most industries along the waterfront operate under hurricane protection plans when the need arises.

With regard to hurricane flood protection in the future, no major federal projects are proposed for the study area. Based upon communication with numerous cities and private industries located within the study area, no locally constructed flood protection works are planned at this time.

3.0 ENGINEERING METHODS

For the flooding sources studied in detail in the community, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this study. Flood events of a magnitude which are expected to be equalled or exceeded once on the average during any 10-, 50-, 100-, and 500-year period (recurrence intervals), have been selected as having special significance for flood plain management and for flood insurance premium rates. These events, commonly termed the 10-, 50-, 100-, and 500-year floods, have a 10, 2, 1, and 0.2 percent chance, respectively, of being equalled or exceeded during any year. Although the recurrence interval represents the long term, average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than one year are considered. For example, the risk of having a flood which equals or exceeds the 100-year flood (one percent chance of annual occurrence) in any 50 year period is about 40 percent (four in 10), and for any 90 year period, the risk increases to about 60 percent (six in 10). The analyses reported here reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

3.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish peak and discharge-frequency relationships for floods of the selected recurrence intervals for each flooding source studied within the community. Distinctly different types of hydrologic analyses were performed for stream (rainfall-runoff) sources versus tidal surge related sources.

Flood discharges of streams, except the Nueces River, selected for a detailed analysis were based on the U.S. Geological Survey (USGS) open-file report 77-110 "Technique for Estimating the Magnitude and Frequency of Floods in Texas" (Reference 5). This technique was developed by the USGS through a regression analyses of existing gaged streamflow records. These results were then further refined for six specific regions within the state. The area of concern for this study is located within Region 1. Peak discharges for 10-, 50-, and 100-year frequencies were estimated from these relationships using the drainage area and channel slope for the streams in question. Peak discharges for the 500-year frequency events were determined by a straight line extrapolation of the 10-, 50-, and 100-year data on log-probability graph paper. Peak discharge for the Nueces River were estimated from a statistical analysis of the USGS flow data. The peak discharge-drainage area relationships, for the selected recurrence intervals, for these streams are presented in Table 1, "Summary of Discharges".

TABLE 1 - SUMMARY OF DISCHARGES

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cfs) 10-YEAR	50-YEAR	100-YEAR	500-YEAR
NUECES RIVER					
At Calallen Dam	16,920	51,900	95,000	115,200	161,700
At Mathis Dam	16,000	51,400	94,600	114,000	160,000
OSO CREEK					
At FM 2444	144.0	12,500	19,400	23,700	56,100
OSO CREEK TRIBUTARY NO.5					
At FM 2444	8.02	930	1,440	1,640	2,230
At Chapman Ranch Road	7.52	890	1,370	1,560	2,050
At County Road 47	6.02	760	1,160	1,310	1,750
At County Road 49	4.52	620	930	1,040	1,370
OSO CREEK TRIBUTARY NO. 6					
At Acushivet Road	4.32	553	803	894	1,150
At Congressional Drive	3.00	427	606	671	900
At Killarmet Drive	2.34	357	500	551	730
At U.S. Government Railroad	1.10	208	280	304	390
OSO CREEK TRIBUTARY No. 10					
At Saratoga Boulevard	27.10	2,254	3,738	4,359	6,150
At U.S. Government Railroad	5.45	618	890	989	1,270
At South Padre Island Drive	4.58	546	779	862	1,110
At West Point Road	3.03	406	566	623	810
OSO CREEK TRIBUTARY NO. 14					
At McGloin Road	5.76	810	1,280	1,470	2,000
At State Highway 44	3.37	560	850	960	1,280
DITCH A					
At Missouri Pacific Railroad	11.90	1,300	2,080	2,400	3,300
At Bosquez Street	11.08	1,230	1,970	2,270	3,150
At County Road 42	5.51	650	960	1,070	1,400
DITCH B					
At Confluence with Ditch BN	2.83	420	590	650	860
DITCH BN					
At Airport Road	5.92	670	970	1,080	1,430
At Texas-Mexican Railroad	5.07	600	860	960	1,240
At State Highway 44	2.83	420	590	650	860
DITCH C					
Confluence of Ditch E	2.50	500	770	880	1,220

TABLE 1 - SUMMARY OF DISCHARGES - cont.

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cfs)			
		10-YEAR	50-YEAR	100-YEAR	500-YEAR
DITCH F					
Confluence of Ditch E	2.50	500	770	880	1,220
DITCH F					
At confluence with Ditch A	5.23	670	980	1,100	1,420
CARRETTA CREEK					
At U.S. Highway 77 Baypass located at 7,000 ft. downstream of corporate limits	24.02	2,476	4,350	5,170	7,700
At Birch Avenue	22.99	2,399	4,210	5,000	7,500
At North Avenue H	22.06	2,330	4,075	4,840	7,200
NORTH CARRETTA CREEK					
At Business U.S. Highway 77	5.48	760	1,170	1,335	1,780
At North Avenue C	3.73	330	660	1,020	1,200
OSO BAY TRIBUTARY NO. 2					
At Rodd Road	2.62	500	925	1,120	1,590
At Woolridge Road	1.18	330	660	1,020	1,200

The procedures utilized to determine tidal surge-elevation relationships for the shoreline are based on joint probability methods that utilize historical data of individual storm parameters. The overall methodology was developed for use in Flood Insurance Studies by Tetra Tech, Inc. (Reference 6). The statistical distributions of the storm parameters which govern flood levels were examined both individually and collectively. From these distributions, a large population of "synthetic storms" were generated. Such storms are "synthetic" because they only resemble historically observed storms. The procedure permits the simulations of hundreds or several thousand years of storms from which reliable estimates of flood recurrence intervals can be made. The major storm parameters necessary to define a storm are central pressure, radius to maximum winds, forward speed, direction of travel, point at which it crosses the coast, or the distance offshore if parallel to the coast. Each of these parameters is subjected to statistical analysis to determine its probability of occurrence.

The Tetra Tech methodology is based on the assumption that the parameters characterizing a tropical storm are independent of each other, therefore the probability distribution for each parameter can be determined independently of the other parameters. Consequently, the probability of a tropical storm defined by a given combination of parameters has a probability equivalent to the product of the probabilities of these parameters. The values representing the parameters used in this analysis and their assigned probabilities are shown in Table 2, "Parameter Values for Surge Elevation Computations". Following simulation of the storms, recurrence intervals (10-, 50-, 100- and 500-year) for peak storm surge elevations at the shoreline were computed as specified in the Tetra Tech methodlogy.

In the present analysis the astronomical tide amplitudes were added to the surge heights, once the latter were processed and interpreted as surge height exceedence frequencies. For a given location, the two non-linear functions representing the exceedence curve for the surge heights and the probability density function for the astronomical tide were combined by means of a convolution intergal to obtain a new exceedence curve containing the possible combinations of phase of the peak surges with the astronomical tide amplitudes. The probability density function for the astronomical tide is calculated as a Gaussian distribution based on tidal amplitudes generated at regular intervals for a period of time with the use of predictive equations that contain the harmonic constants for all the harmonic components of the tide at a particular location.

3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of the flooding sources studied in detail in the community were carried out to provide estimates of elevations for the selected recurrence intervals along each of the studied streams as well as lowland areas near the shoreline.

Cross sections for the backwater analyses of streams were obtained by field surveying using 3rd-order accuracy. Dimensions of all bridges and culverts were determined by field measurement or field checked to verify structural geometry from construction plans. The locations of selected cross sections used in the hydraulic analyses are shown on the Flood Profiles (Exhibit 1). For streams for which a floodway was computed (Section 4.2), selected cross section locations are also shown on the Flood Boundary and Floodway Map (Exhibit 3).

CENTRAL PRESSURE DEPRESSION (Millibars) **PROBABILITY:** **ENTERING** **EXITING** **PARALLEL**	29.72 0.10	29.20 0.40	28.37 0.40	27.55 0.10
STORM RADIUS (Nautical Miles) **PROBABILITY**	12.20 0.30	18.80 0.48	28.80 0.28	
FORWARD SPEED (Knots) **PROBABILITY:** **ENTERING** **EXITING** **PARALLEL**	6.70 0.52	11.50 0.22	14.70 0.14	12.20 0.12
CROSSING ANGLE (Degrees) **PROBABILITY**	-34.0 0.11	221.00 0.19	264.00 0.48	302.00 0.22
FREQUENCY OF OCCURRENCE	0.00144 Storms/NM-YR			

*Positive clockwise from north.

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

NUECES COUNTY, TX

(UNINCORPORATED AREAS)

PARAMETER VALUES FOR SURGE ELEVATION COMPUTATIONS

13

The channel roughness coefficients (Mannings "n") used in the hydraulic computations were chosen by engineering judgement and based on field inspection of each stream and its overbank area. A roughness coefficient of 0.045 was used for the main channel of the streams, and a roughness coefficient of 0.060 was used for the overbanks. The acceptability of all assumed hydraulic factors, cross sections and hydraulic structure data was checked by computations that duplicated historic flood water profiles.

Water-surface elevations of floods, due to the streamflow, of the selected recurrence intervals were computed using the U.S. Army Corps of Engineers (COE) HEC-2 backwater computer program (Reference 7). The starting water-surface elevations for all streams studied were calculated using the slope-area method. Water-surface profiles were drawn showing computed water-surface elevations determined to an accuracy of 0.5 foot for floods of the selected recurrence intervals.

The hydraulic analyses for this study were based on unobstructed flow through the various structures that are located in the flowpath. The flood elevations shown on the profiles are thus considered valid only if the hydraulic structures remain unobstructed, operate properly, and do not fail.

Because surge elevations of inland areas are often higher than those at the shoreline due to funneling and the movement of the surge onto higher ground, an overland propagation model (SURGEOD) was utilized to determine inland surge heights and flooding limits (Reference 6). SURGEOD is a one dimensional model with movable boundary conditions which proceeds landward in its computations comparing the water surface level at the landward limit with the ground level at the next landward elevation. When the water surface level is higher than the ground level, a "wall" boundary condition is advanced one element landward until the surge level declines to zero. The propagation model generated an explicit finite difference solution to the hydrodynamic equation of long wave propagation. The momentum and continuity equations are utilized in non-linear transport form.

Input to the overland propagation model consists of surge levels (with the associated recurrence intervals derived from the storm surge model), Manning's friction coefficient, and ground elevations along the traverse. The principal output of the program includes flood levels for the 10-, 50-, 100-, and 500-year floods at each ground point on the traverse.

A grid consisting of 2.5 nautical miles per side was used throughout the study area. The grid extended from the Kleberg County/Kenedy County boundary to just north of East Matagorda Bay and offshore approximately 63 miles. The grid covered an area of approximately 10,350 square miles.

Water depths for the offshore area were obtained from National Ocean Survey bathymetric maps at a scale of 1:25,000 and for near shore area from National Ocean Survey hydrographic surveys with various dates and scales (References 8 and 9).

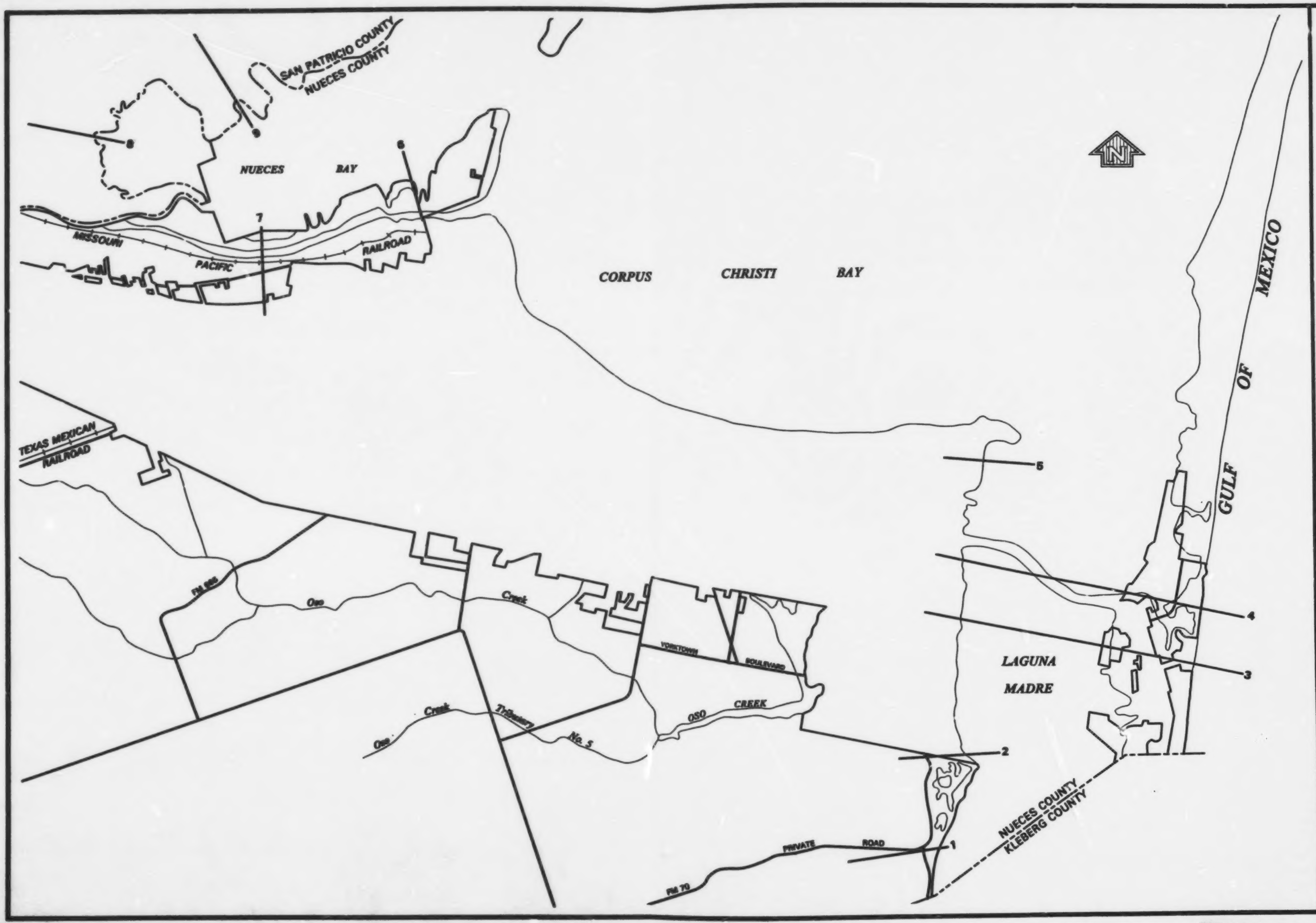
The computed stillwater elevations for Nueces County are tabulated in The Coastal Flood Insurance Zone Data Table (see section 5.3).

The final consideration in assessing the severity of flood hazards in the area as related to storm surge involves the determination of wave action during such storms.

3.3 Wave Height Analysis

The methodology for analyzing the effects of wave heights associated with coastal storm surge flooding is described in the National Academy of Sciences report (Reference 10). This method is based on the following major concepts. First, depth-limited waves in shallow water reach a maximum breaking height that is equal to 0.78 times the stillwater depth. The wave crest elevations is 70 percent of the total wave height plus the stillwater elevation. The second major concept is that wave height may be diminished due to the presence of obstructions such as sand dunes, dikes and seawalls, buildings and vegetation. The amount of energy dissipation is a function of the physical characteristics of the obstruction and is determined by procedures prescribed in Reference 10. The third major concept is that wave height can be regenerated in open fetch areas due to the transfer of wind energy to the water. This added energy is related to fetch length and depth.

Wave heights were computed along transects (cross section lines) that were located along the coastal areas, as illustrated in Figure 3 "Transect Location Map", in accordance with the Users Manual for Wave Height Analysis (Reference 11). The transects were located with consideration given to the physical and cultural characteristics of the land so that they would closely represent conditions in their locality. Transects were spaced close together in areas of complex topography and dense development. In areas havng more uniform charcteristics, they were spaced at larger intervals. It was also necessary to locate transects in areas where unique flooding existed and in areas where computed wave heights varied significantly between adjacent transects.


SAN PATRICIO COUNTY
NUECES COUNTY
8
9
6
NUECES BAY
7
MISSOURI PACIFIC RAILROAD
CORPUS CHRISTI BAY
N
GULF OF MEXICO
TEXAS MEXICAN RAILROAD
FM 665
Oso Creek
5
YORKTOWN BOULEVARD
4
3
LAGUNA MADRE
Oso Creek Tributary No. 5
OSO CREEK
2
NUECES COUNTY
KLEBERG COUNTY
PRIVATE ROAD
1
FM 70

TRANSECT LOCATION MAP

FEDERAL EMERGENCY MANAGEMENT AGENCY

NUECES COUNTY, TX

(UNINCORPORATED AREAS)

FIGURE 3

The transects were continued inland until the wave was dissipated or until flooding from another source with equal or greater elevation was reached. Along each transect, wave heights and elevations were computed considering the combined effects of changes in ground elevation, vegetation and physical features. The stillwater elevations for the 100-year flood were used as the starting elevations for these computations. Wave heights were calculated to the nearest 0.1 foot, and wave elevations were determined at whole-foot increments along the transects. Areas with a wave component 3-feet or greater were designated as velocity zones. Other areas subject to wave action were designated as A Zones with base flood elevations adjusted to include wave crest elevations.

Figure 4 is a profile for a hypothetical transect showing the effects of energy dissipation on a wave as it moves inland. This figure shows the wave elevations being diminished by obstructions, such as buildings, vegetation and rising ground elevations and being increased by open, unobstructed wind fetches. Actual wave conditions in Nueces County may not necessarily include all the situations illustrated in Figure 4.

Computed wave elevations are based upon existing topography, vegetation and current development patterns and will require re-computation if significant changes occur in any of the above factors.

All elevations are referenced to the National Geodetic Vertical Datum of 1929 (NGVD), formerly referred to as Mean Sea Level Datum of 1929. Elevation reference marks used in this study are shown and described on the maps.

4.0 FLOOD PLAIN MANAGEMENT APPLICATIONS

A prime purpose of the National Flood Insurance Program is to encourages state and local governments to adopt sound floodplain management programs. Therefore, each Flood Insurance Study includes a flood boundary and floodway map designed to assist communities in developing sound floodplain management measures.

4.1 Flood Boundaries

In order to provide a national standard without regional discrimination, the 100-year flood has been adopted by FEMA as the base flood for purposes of floodplain management measures. The 500-year flood is employed to indicate additional areas of flood risk in the community. For each stream

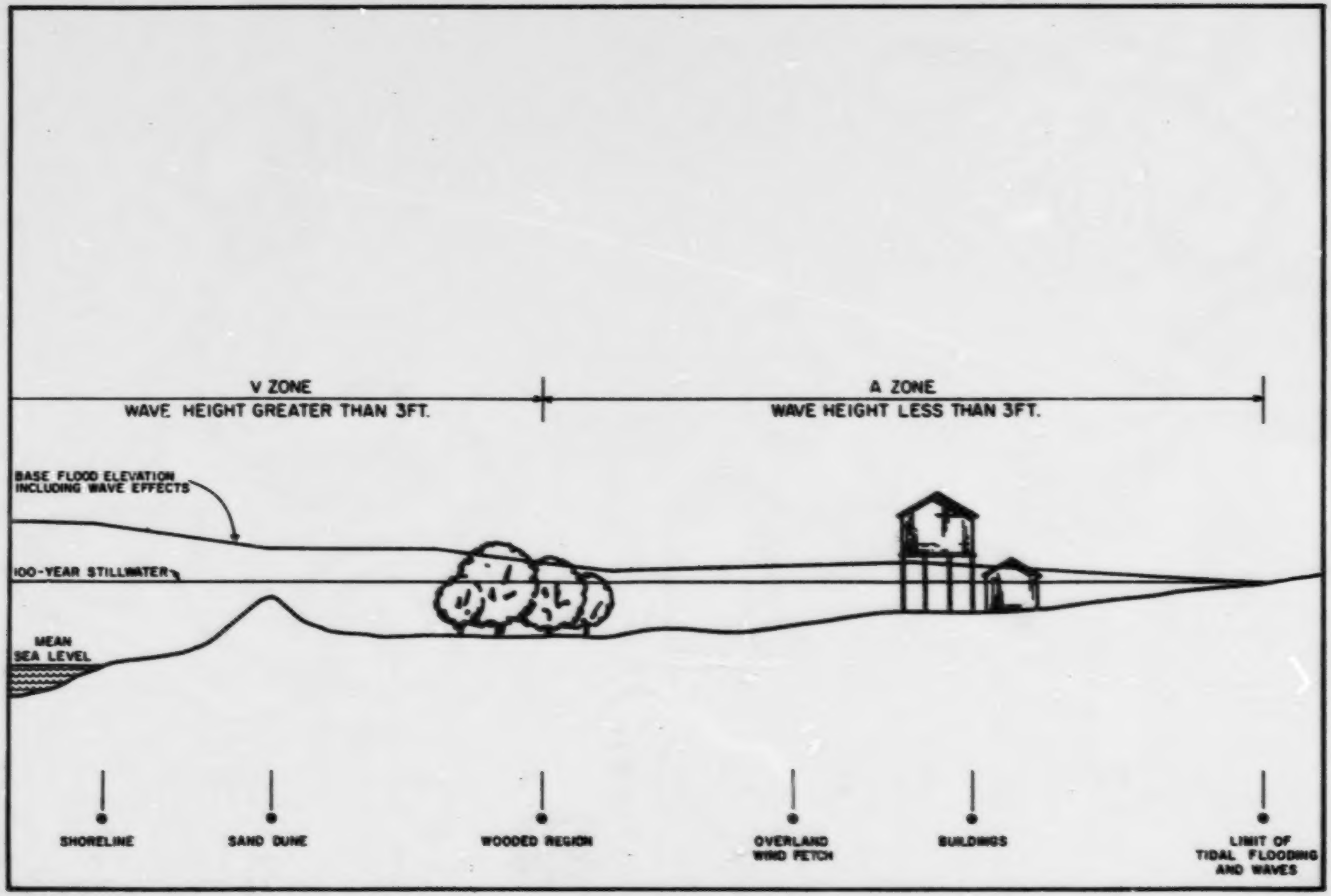

V ZONE
WAVE HEIGHT GREATER THAN 3FT.
A ZONE
WAVE HEIGHT LESS THAN 3FT.
BASE FLOOD ELEVATION INCLUDING WAVE EFFECTS
100-YEAR STILLWATER
MEAN SEA LEVEL
SHORELINE
SAND DUNE
WOODED REGION
OVERLAND WIND FETCH
BUILDINGS
LIMIT OF TIDAL FLOODING AND WAVES

FIGURE 4
HYPOTHETICAL TRANSECT SCHEMATIC

studied in detail, the boundaries of the 100- and the 500-year floods have been delineated using the flood elevations determined at each cross section; between cross sections, the boundaries were interpolated using topographic maps at a scale of1:24,000 with a contour interval of 5 feet (Reference 12). In cases where the 100-year and the 500-year boundaries are close together, only the 100-year boundary has been shown.

The 100- and 500-year flood boundaries along the coastline were delineated along transects that were surveyed perpendicular to the shoreline. The flood boundary extensions between transects were located by interpolation and the assistance of the existing topographic maps (Reference 12).

The boundaries of the 100- and 500-year floods are shown on the Flood Insurance Rate Map (FIRM). On this map, the 100-year boundary corresponds to the areas of special flood hazards (Zones A and V) and the 500-year boundary corresponds to the boundary of moderate flood hazard (Zone B). In cases where the 100- and 500-year flood boundaries are practically indistinguishable only the 100-year flood boundary has been shown.

Small areas within the flood boundareas may lie above the flood elevations and, therefore, not be subject to flooding. Owing to limitations of the map scale and/or lack of detailed topographic data, such areas are not shown.

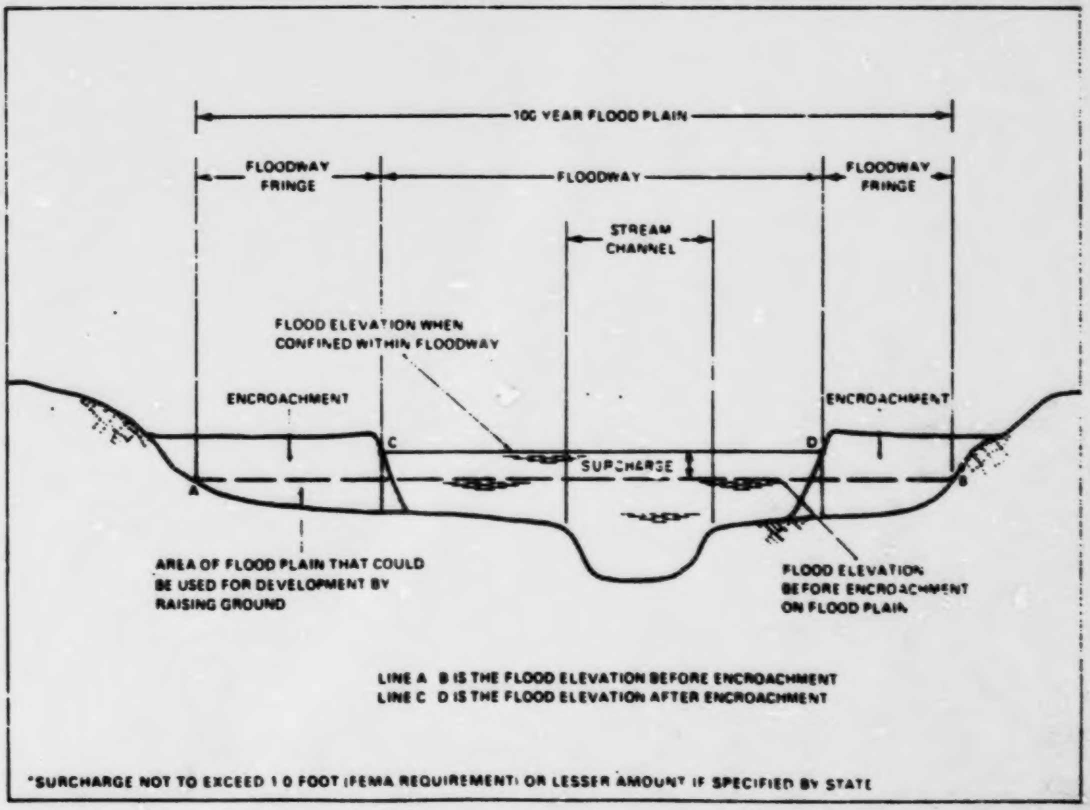
4.2 Floodways

Encroachment on flood plains, such as artificial fill, reduces the flood-carrying capacity, increases the flood heights of streams, and increases flood hazards in areas beyond the encroachment itself. One aspect of flood plain management involves balancing the economic gain from flood plain development against the resulting increase in flood hazard. For purposes of the National Flood Insurance Program, the concept of a floodway is used as a tool to assist local communities in this aspect of flood plain management. Under this concept, the area of the 100-year flood is divided into a floodway and a floodway fringe. The floodway is the channel of a stream plus any adjacent flood plain areas that must be kept free of encroachment in order that the 100-year flood may be carried without substantial increases in flood heights. Minimum standards of FEMA limit such increases in flood heights to 1.0 foot, provided that hazardous velocities are not produced. The floodways in this report are presented to local agencies as minimum standards that can be adopted or that can be used as a basis for additional studies.

Floodways are not delineated in coastal high hazard areas. The floodways presented in this study were computed on the basis of equal conveyance reduction from each side of the flood plain. The results of these computations are tabulated at selected cross sections for each stream segment for which a floodway was computed (Table 3).

As shown on the FBFM (Exhibit 3), the floodway widths were determined at cross sections; between cross sections, the boundaries were interpolated. In cases where the floodway and the 100-year boundaries are either close together or collinear, only the floodway boundary has been shown.

The area between the floodway and the boundary of the 100-year flood is termed the floodway fringe. The floodway fringe thus encompasses the portion of the flood plain that could be completely obstructed without increasing the water-surface elevation of the 100-year flood more than 1.0 foot at any point. Typical relationships between the floodway and the floodway fringe and their significance to flood plain development are shown in Figure 5.


100 YEAR FLOOD PLAIN
FLOODWAY FRINGE
FLOODWAY
FLOODWAY FRINGE
STREAM CHANNEL
FLOOD ELEVATION WHEN CONFINED WITHIN FLOODWAY
ENCROACHMENT
ENCROACHMENT
C
D
SURCHARGE
A
B
AREA OF FLOOD PLAIN THAT COULD BE USED FOR DEVELOPMENT BY RAISING GROUND
FLOOD ELEVATION BEFORE ENCROACHMENT ON FLOOD PLAIN
LINE A B IS THE FLOOD ELEVATION BEFORE ENCROACHMENT
LINE C D IS THE FLOOD ELEVATION AFTER ENCROACHMENT
*SURCHARGE NOT TO EXCEED 1.0 FOOT (FEMA REQUIREMENT) OR LESSER AMOUNT IF SPECIFIED BY STATE

FLOODWAY SCHEMATIC

Figure 5

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE
Nueces River (Part 1)								
A	0[1]	10,831[3]	69,440	1.6	30.2	30.2	31.2	1.0
B	13,600[1]	9,515[3]	39,679	2.9	34.6	34.6	35.6	1.0
C	28,825[1]	10,939[3]	83,351	1.4	38.2	38.2	39.0	0.8
D	44,025[1]	5,974[3]	33,479	3.4	41.5	41.5	42.5	1.0
Nueces River (Part 2)								
A	0[2]	8,166[3]	52,713	2.2	14.0	10.9[5]	11.8	0.9
B	215[2]	7,364[3]	21,519	5.4	14.0	11.0[5]	12.0	1.0
C	3,415[2]	2,815[3]	22,295	5.2	14.0	13.3[5]	14.3	1.0
D	3,577[2]	2,762[3]	21,194	5.4	14.0	13.7[5]	14.6	0.9
E	9,177[2]	7,544[4]	78,651	1.5	14.8	14.8	15.7	0.9
F	13,077[2]	13,087[4]	137,039	0.8	14.9	14.9	15.8	0.9
G	15,077[2]	13,859[4]	139,601	0.8	14.9	14.9	15.8	0.9
H	17,677[2]	15,469[4]	153,422	0.8	15.0	15.0	15.9	0.9
I	20,777[2]	14,167[4]	106,040	1.1	15.0	15.0	15.9	0.9
J	22,877[2]	15,153[4]	126,505	0.9	15.1	15.1	16.0	0.9
K	25,477[2]	12,402[4]	80,235	1.4	15.3	15.3	16.3	1.0
L	26,977[2]	14,170[4]	94,671	1.2	15.4	15.4	16.4	1.0
M	29,077[2]	14,908[4]	85,213	1.4	15.7	15.7	16.7	1.0
N	31,577[2]	16,378[4]	76,791	1.5	16.1	16.1	17.1	1.0

[1] Feet above San Patricio County/Nueces County

[2] Feet above 200 feet downstream of Missouri Pacific Railroad

[3] Floodway width extends beyond county limits

[4] Floodway width located outside county limits

[5] Elevation computed without consideration of coastal effects

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

NUECES COUNTY, TEXAS
(UNINCORPORATED AREAS)

FLOODWAY DATA

NUECES RIVER (PART 1) - NUECES RIVER (PART 2)

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD)			
Oso Creek								
A	50[1]	1,100	10,5321	2.3	15.1	15.1	16.0	0.9
B	3,250[1]	1,440	16,553	1.4	15.5	15.5	16.5	1.0
C	5,430[1]	1,103	10,371	2.2	15.8	15.8	16.8	1.0
D	8,480[1]	1,125	13,852	1.7	16.5	16.5	17.5	1.0
E	11,780[1]	1,196	12,904	1.8	17.0	17.0	17.9	0.9
F	16,080[1]	432	5,327	4.4	17.7	17.7	18.6	0.9
G	19,880[1]	1,118	13,354	1.7	18.5	18.5	19.4	0.9
H	22,230[1]	884	12,147	1.8	18.8	18.8	19.8	1.0
I	24,100[1]	565	7,123	3.3	19.2	19.2	20.2	1.0
J	27,400[1]	554	7,217	2.9	20.2	20.2	21.2	1.0
K	31,130[1]	1,305	16,068	1.2	20.8	20.8	21.8	1.0
L	33,960[1]	307	4,089	4.5	21.1	21.1	22.1	1.0
M	36,230[1]	442	5,586	3.3	23.3	23.3	24.3	1.0
N	38,200[1]	658	8,331	2.2	24.2	24.2	25.2	1.0
O	42,200[1]	936	12,399	1.5	24.8	24.8	25.8	1.0
Oso Creek Tributary No. 5								
A	0[2]	105	449	2.6	13.1	7.9[3]	8.9	1.0
B	2,100[2]	53	303	3.9	13.2	10.3[3]	11.1	0.8
C	4,500[2]	55	292	4.0	14.4	14.0[3]	14.1	0.1
D	7,700[2]	108	283	3.6	18.8	18.8	19.4	0.6
E	9,100[2]	250	550	0.5	19.8	19.8	20.8	1.0

[1] Feet from FM 2444

[2] Feet above 17,100 feet downstream of FM 2244

[3] Computed without consideration of coastal effects

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

NUECES COUNTY, TEXAS
(UNINCORPORATED AREAS)

FLOODWAY DATA

OSO CREEK - OSO CREEK TRIBUTARY NO. 5

BEST COPY AVAILABLE

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD)			
Oso Creek Tributary No. 5 (continued)								
F	11,600	116	197	1.4	20.2	20.2	21.2	1.0
G	14,000	162	256	1.1	21.6	21.6	22.5	0.9
H	17,116	46	133	2.0	23.2	23.2	23.8	0.6
I	18,697	50	131	2.1	24.6	24.6	24.8	0.2
J	20,497	126	279	1.0	25.2	25.2	25.6	0.4
K	21,797	191	739	2.1	25.4	25.4	26.2	0.8
L	23,347	904	4,215	0.4	27.7	27.7	28.5	0.8

[1] Feet above 17,100 feet downstream of FM 2244

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

NUECES COUNTY, TEXAS

(UNINCORPORATED AREAS)

FLOODWAY DATA

OSO CREEK TRIBUTARY NO. 5

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD)			
Oso Creek Tributary No. 5 (cont.)								
M	26,147	712	1,377	1.1	27.8	27.8	28.7	0.9
N	27,747	430	982	1.3	30.6	30.6	31.6	1.0
O	29,063	354	774	1.7	31.7	31.7	32.6	0.9
P	31,163	544	1,105	1.2	33.4	33.4	34.4	1.0
Q	33,063	557	1,259	0.8	34.3	34.3	35.3	1.0
Oso Creek Tributary No. 6								
A	3,923	60	401	3.9	18.3	18.3	18.6	0.3
B	4,826	58	435	3.4	18.9	18.9	19.1	0.2
Oso Creek Tributary No. 10								
A	0	167	993	4.9	20.8	17.4[2]	18.3[2]	0.9
B	1,700	191[3]	1,511	3.2	20.8	19.3[2]	20.3[2]	1.0
C	4,250	160[3]	1,092	4.3	21.1	21.1	21.9	0.8
Oso Creek Tributary No. 14								
A	0	53	346	5.2	34.0	30.6	31.6	1.0
B	3,060	50	323	5.2	36.0	36.0	36.0	0.0
C	4,110	56	332	4.9	37.6	37.6	37.6	0.0
D	6,548	54	307	5.1	41.1	41.1	41.1	0.0
E	8,768	43	388	3.8	43.7	43.7	43.7	0.0

[1] Feet above 17,100 feet downstream of FM 2244 for Oso Creek Tributary No. 5; feet above 700 feet above mouth for Oso Creek Tributary No. 6; feet above 2,300 feet above mouth for Oso Creek Tributary No. 10; feet above 1,650 feet above mouth for Oso Creek Tributary No. 14.

[2] Computed without consideration of backwater effects.

[3] Width located outside county limits.

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

NUECES COUNTY, TX

(UNINCORPORATED AREAS)

FLOODWAY DATA

OSO CREEK TRIBUTARY NO. 5 - OSO CREEK TRIBUTARY NO. 6
OSO CREEK TRIBUTARY NO. 10 - OSO CREEK TRIBUTARY NO. 14

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD)			
Oso Creek Tributary No. 14 (cont.)								
F	11,255	307	840	1.6	44.8	44.8	45.4	0.6
G	12,655	327	1,005	1.1	45.0	45.0	45.9	0.9
H	13,135	399[2]	1,300	0.8	45.0	45.0	45.9	0.9
I	14,435	422[3]	1,455	0.7	45.1	45.1	46.1	1.0
J	16,435	445[3]	1,314	0.7	45.2	45.2	46.2	1.0
K	17,385	357[3]	972	1.0	45.3	45.3	46.3	1.0
L	17,509	50[3]	315	3.0	45.4	45.4	46.3	0.9
M	18,263	250[3]	900	0.8	46.3	46.3	46.6	0.3
N	19,463	250[3]	861	0.8	46.3	46.3	46.9	0.6
O	20,463	250[3]	664	1.0	46.3	46.3	47.1	0.8
P	21,513	278[3]	850	0.8	46.4	46.4	47.4	1.0
Ditch A								
B	10,600	2,500	2,039	1.8	69.3	69.3	69.6	0.3
C	13,200	2,500	2,423	1.0	71.7	71.7	72.7	1.0
D	15,505	63[3]	420	5.2	72.7	72.7	73.6	0.9
E	15,625	1,224[3]	2,265	1.0	73.9	73.9	74.6	0.7
F	17,745	1,229[3]	453	4.8	75.8	75.8	76.1	0.3
G	20,520	50[3]	363	6.0	77.5	77.5	78.5	1.0
H	22,045	1,022[3]	2,283	1.0	78.8	78.8	79.8	1.0
I	23,435	781[3]	1,460	1.6	79.6	79.6	80.4	0.8
J	24,795	1,274[2]	2,772	0.8	80.3	80.3	81.0	0.7

[1] Feet above 1650 feet above mouth for Oso Creek Tribtuary No. 14; feet above 5100 feet downstream of FM 1694 for Ditch A.

[2] Width extends beyond county limits.

[3] Width located outside county limits.

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

NUECES COUNTY, TX

(UNINCORPORATED AREAS)

FLOODWAY DATA

OSO CREEK TRIBUTARY NO. 14 -DITCH A

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
						(FEET NGVD)		
Ditch B								
A	1,750	41	227	2.3	80.3	80.3	81.3	1.0
B	4,416	76	272	2.3	82.5	82.5	83.2	0.7
C	7,016	682	2,223	0.3	82.9	82.9	83.6	0.7
Ditch BN								
A	50	193	242	4.5	78.0	78.0	79.0	1.0
B	2,780	332	1,944	0.6	79.3	79.3	80.1	0.8
C	5,480	324	1,311	0.8	79.3	79.3	80.2	0.9
D	8,530	398[2]	972	1.0	79.3	79.3	80.3	1.0
E	8,700	320[2]	1,154	0.8	79.5	79.5	80.4	0.9
F	10,410	477	2,288	0.4	79.6	79.6	80.6	1.0
G	11,700	677	996	0.9	79.6	79.6	80.6	1.0
Ditch C								
B	8,596	98	1,026	1.7	67.1	67.1	67.7	0.6
Ditch F								
A	3,000	1,695	6,382	0.2	80.7	80.7	81.7	1.0
B	4,350	664	1,736	0.6	80.7	80.7	81.7	1.0
C	5,650	685	2,343	0.5	80.9	80.9	81.9	1.0
Carretta Creek								
A	1,850	132	815	6.3	39.5	39.5	39.5	0.0
B	2,000	132	826	6.3	39.6	39.6	39.6	0.0
C	2,050	198	1,216	4.3	40.1	40.1	40.1	0.0
D	4,120	150	930	5.6	42.7	42.7	42.7	0.0
E	4,220	121	985	5.2	43.0	43.0	43.1	0.1

[1] Feet above mouth for Ditch B and Ditch F; feet above limit of detailed study for Ditch BN; feet above 125 feet downstream of FM 1694 for Ditch C; feet above confluence of North Carretta Creek for Carretta Creek.

[2] Width extends beyond county limits.

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

NUECES COUNTY, TX

(UNINCORPORATED AREAS)

FLOODWAY DATA

DITCH B-DITCH BN-DITCH C-DITCH F-CARRETTA CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD)			
Carretta Creek (cont.)								
F	5,320	110	997	5.2	44.6	44.6	45.1	0.5
G	9,120	354[2]	1,592	3.2	51.7	51.7	52.7	1.0
H	10,320	300[2]	2,628	2.0	52.5	52.5	53.3	0.8
I	11,520	230[2]	2,970	1.7	52.5	52.5	53.3	0.8
J	12,030	140[2]	1,191	4.2	54.5	54.5	55.5	1.0
K	12,130	154[2]	1,293	3.9	54.7	54.7	55.7	1.0
L	12,210	180[2]	1,412	3.5	54.8	54.8	55.6	0.8
M	14,210	153[2]	1,016	4.9	56.7	56.7	57.7	1.0
N	15,610	410	2,314	2.1	57.8	57.8	58.8	1.0
North Carretta Creek								
A	0	185	826	2.3	46.8	46.8	47.8	1.0
B	1,500	193	903	2.1	48.0	48.0	48.5	0.5
C	2,860	156	722	2.6	48.9	48.9	49.2	0.3
D	4,300	131	648	2.9	50.5	50.5	50.6	0.1
E	5,930	146	751	2.5	52.1	52.1	52.1	0.0
F	7,130	164	659	2.3	52.6	52.6	52.6	0.0
G	8,130	150	889	1.7	52.8	52.8	52.8	0.0
H	8,330	144	873	1.8	52.9	52.9	52.9	0.0
Oso Bay Tributary No. 2								
A	0	108	377	3.2	9.6	5.3[3]	6.3[3]	1.0
B	1,500	284	836	1.4	9.6	7.1[3]	7.3[3]	0.2

[1] Feet above confluence of North Carretta Creek for Carretta Creek; feet above downstream limit of detailed study for North Carretta Creek; feet above 5170 feet below Rodd Road for Oso Bay Tributary No. 2.

[2] Width located outside county limits.

[3] Elevation computed without consideration of coastal effects.

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

NUECES COUNTY, TX

(UNINCORPORATED AREAS)

FLOODWAY DATA

CARRETTA CREEK-NORTH CARRETTA CREEK- OSO BAY TRIBUTARY NO. 2

4.3 Base Flood Elevations

Areas within the community studied by detailed engineering methods have base flood elevations established in A and V Zones. These are the elevations of the base (100-year flood relative to the National Geodetic Vertical Datum (mean sea level of 1929). In coastal areas affected by wave action, base flood elevations are generally maximum at the normal open shoreline. These elevations generally decrease in a landward direction at a rate dependent on the presence of obstructions capable of dissipating the wave energy. Where possible, changes in base flood elevations have been shown in 1-foot increments on the FIRMs. However, where the scale did not permit, 2- or 3-foot increments were sometimes used. Base flood elevations shown in the wave action areas represent the average elevation within the zone. Current program regulations generally require that all new construction be elevated such that the first floor, including basement, is above the base flood elevation in A and V Zones.

4.4 Velocity Zones

The U.S. Army Corps of Engineers (Reference 13) has established the 3-foot wave as the criterion for identifying coastal high hazard zones. This was based on a study of wave action effects on structures. This criterion has been adopted by the Federal Emergency Management Agency for the determination of V Zones. Because of the additional hazards associated with high-energy waves, the National Flood Insurance Program regulations require much more stringent flood plain management measures in these areas, such as elevating structures on piles or piers. In addition, insurance rates in V Zones are higher than those in A Zones with similar numerical designations.

5.0 INSURANCE APPLICATION

In order to establish actuarial insurance rates, FEMA has developed a process to transform the data from the engineering study into flood insurance criteria. This process includes the determination of reaches, Flood Hazard Factors (FHFs), and flood insurance zone designations for each significant flooding source affecting the community.

5.1 Reach Determinations

Reaches are defined as lengths of watercouses having relatively the same flood hazard, based on the average weighted difference in water-surface elevations between the 10- and 100-year floods. This difference does not have a variation greater than that indicated in the following table for more than 20 percent of the reach.

Average Difference Between 10- and 100-Year Floods	Variation
Less than 2 feet	0.5 foot
2 to 7 feet	1.0 foot

The location of reaches determined for the flooding sources of Nueces County are shown on the Flood Profiles (Exhibit 1), and summarized in the Flood Insurance Zone Data Table (See Section 5.3).

Coastal flood plains are divided into areas having relatively the same flood hazard based upon the 100-year wave crest elevation, the 100-year wave height, and the average weighted difference in water-surface elevations between the 10-year and 100-year floods. These flood hazard areas are shown on the Flood Insurance Rate Map.

5.2 Flood Hazard Factors (FHFs)

The Flood Hazard Factor is used to correlate flood information with insurance rate tables. Correlations between property damages from floods and their assigned FHFs are used to set actuarial insurance premium rate tables based on FHFs from 005 to 200.

The FHF for a reach is the average weighted difference between the 10- and 100-year flood water-surface elevations expressed to the nearest one-half foot, and shown as a three-digit code. For example, if the difference between the water-surface elevations of the 10- and 100-year floods is 0.7 foot, the FHF is 005; if the difference is 1.4 feet, the FHF is 015; if the difference is 5.0 feet, the FHF is 050. When the difference between the 10- and 100-year flood water-surface elevations is greater than 10.0 feet, the accuracy for the FHF is to the nearest foot.

In coastal areas subject to wave action (wave heights greater than 3 feet), the FHF is determined using the difference between the 10-year and 100-year wave crest elevations. This difference is estimated as the difference between the 10- and 100-year stillwater elevations multiplied by 1.55. For areas where wave heights are less than three feet, the FHF is determined using the difference between the 10-year stillwater elevation and the 100-year wave crest elevation. For areas protected from wave action, the FHF is determined using the difference between the 10-year and 100-year stillwater elevations.

5.3 Flood Insurance Zones

After the determination of reaches and their respective FHFs, the entire study area was divided into zones, each having a specific flood potential or hazard. Each zone was assigned one of the following flood insurance zone designations.

Zone A:	Special Flood Hazard Areas inundated by the 100-year flood, determined by approximate methods; no base flood elevations shown or FHFs determined.
Zone(s) A1,A2,A3,A4, A5,A6,A7,A8,A9, A11,A12,A13,A18, A20 and A24:	Special Flood Hazard Areas inundated by the 100-year flood, determined by detailed methods; base flood elevations shown, and zones subdivided according to FHF.
Zone AH:	Special Flood Hazards inundated by types of 100-year where depths are between 1.0 and 3.0; base flood elevations are shown, but no FHF's are deterined.
Zone(s) V14,V21,V22 and V24:	Special Flood Hazard Areas along coast inundated by the 100-year floods, as determined by detailed methods; and that have additional hazards due to velocity (wave action), base flood elevations shown, and zones subdivided according to FHFs.

Zone B:	Areas between the Special Flood Hazard Area and the limits of the 500-year flood, including areas of the 500-year flood plain that are protected from the 100-year flood by dike, levee, or other water control structure; areas subject to certain types of 100-year shallow flooding where depths are less than 1.0 foot; or areas subject to 100-year flooding from sources with drainage areas less than 1 square mile. Zone B is not subdivided.
Zone C:	Areas of minimal flooding.

Table 4, "Flood Insurance Zone Data," and Table 5, "Coastal Flood Insurance Zone Data," summarizes the flood elevation differences, FHFs, flood insurance zones, and base flood elevation for each flooding source studied in detail in Nueces County.

5.4 Flood Insurance Rate Map Description

The Flood Insurance Rate Maps for the Nueces County is, for insurance purposes, the principal result of the Flood Insurance Study. This maps (published separately) contain the official delineation of flood insurance zones and base flood elevation lines. Base flood elevation lines show the locations of the expected whole-foot water-surface elevations of the base (100-year) flood. These maps are developed in accordance with the latest flood insurance map preparation guidelines published by FEMA.

6.0 OTHER STUDIES

A previous Flood Insurance Study Nueces County, Texas was prepared by the U.S. Army Corps of Engineers, Galveston District, Galveston, Texas in August of 1972 for the Federal Insurance Administration. The latest revision to the study is dated September 1976.

Wave height analyses are concurrently being performed for San Patricio and Kleburg counties and the incorporated areas of Corpus Christi, Aransas Pass and Port Aransas. The results of those studies will be in agreement with this study.

Riverine Analyses either have been performed or are currently being performed for the incorporated areas of Corpus Christi, Bishop, Driscoll, Robstown and Agua Dulce. This study will be in agreement with those studies.

FLOODING SOURCE	PANEL[1]	ELEVATION DIFFERENCE[2] BETWEEN 1.0% (100-YEAR) FLOOD AND			FHF	ZONE	BASE FLOOD ELEVATION[3] (NGVD)
		10% (10 YR.)	2% (50 YR.)	0.2% (500 YR.)			
Nueces River Reach 1	30,35,45, 65,68	*	*	*	045	A9	Varies
Nueces River (Part 1) Reach 1	30,35,40, 45	-2.5	-0.6	+1.3	025	A5	Varies
Nueces River (Part 2) Reach 1	68,256, 257	-2.9	-0.9	+2.2	030	A6	Varies
Oso Creek Combined flooding effects with Oso Bay	520	-5.5	-1.1	+3.2	055	A11	Varies

[1] Flood Insurance Rate Map Panel

[2] Weighted Average

[3] Rounded to the nearest foot - see map

*Refer to Nueces County Flood Insurance Studies of 9-27-72 and 9-3-76

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

NUECES COUNTY, TEXAS
(UNINCORPORATED AREAS)

FLOOD INSURANCE ZONE DATA

NUECES RIVER - NUECES RIVER (PART 1) - NUECES RIVER (PART 2) - OSO CREEK

FLOODING SOURCE	PANEL[1]	ELEVATION DIFFERENCE[2] BETWEEN 1.0% (100-YEAR) FLOOD AND			FHF	ZONE	BASE FLOOD ELEVATION[3] (NGVD)
		10% (10 YR.)	2% (50 YR.)	0.2% (500 YR.)			
Oso Creek (continued)							
Reach 1	502,505 508,520	-3.7	-1.3	+3.8	035	A7	Varies
Reach 2	280,295, 300,485	*	*	*	015	A3	Varies
Oso Creek Tributary No. 5 Combined flooding with Oso Bay	520	-2.5	-1.1	+2.3	025	A5	Varies
Reach 1	515,520	-0.6	-0.1	+0.3	005	A1	Varies

[1] Flood Insurance Rate Map Panel

*Refer to Nueces County Flood Insurance Studies of 9-27-72 and 9-3-76

[2] Weighted Average

[3] Rounded to the nearest foot - see map

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

NUECES COUNTY, TEXAS
(UNINCORPORATED AREAS)

FLOOD INSURANCE ZONE DATA

OSO CREEK - OSO CREEK TRIBUTARY NO. 5

FLOODING SOURCE	PANEL[1]	ELEVATION DIFFERENCE[2] BETWEEN 1% (100-YEAR) FLOOD AND			FLOOD HAZARD FACTOR	ZONE	BASE FLOOD ELEVATION (FEET NGVD)[3]
		10% (10-YEAR)	2% (50-YEAR)	0.2% (500-YEAR)			
Oso Creek Tributary No. 6							
Reach 1	508,509, 520	-1.2	-0.4	+0.6	010	A2	Varies
Oso Creek Tributary No. 14							
Reach 1	295,485	-2.3	-0.6	+1.5	025	A5	Varies
Reach 2	295	-1.0	-0.3	+0.7	010	A2	Varies
Ditch A							
Reach 1	275,280, 300	*	*	*	010	A2	Varies
Reach 2	275	-0.8	-0.2	+0.4	010	A2	Varies
Ditch B							
Reach 1	275	-1.3	-0.3	+0.5	015	A3	Varies
Reach 2	275	-0.6	-0.2	+0.5	005	A1	Varies
Ditch BN							
Reach 1	275	-2.4	-0.6	+1.4	025	A5	Varies
Reach 2	275	-2.0	-0.5	+0.8	020	A4	Varies
Reach 3	275	-1.3	-0.3	+1.0	015	A3	Varies
Ditch C							
Reach 1	275,300	*	*	*	010	A2	Varies
Reach 2	275	-4.0	-1.9	+2.1	040	A8	Varies

[1] Flood Insurance Rate Map Panel [2] Weighted Average [3] Rounded to Nearest Foot

*Refer to Nueces County Flood Insurance Studies of 9-27-72 and 9-3-76

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

NUECES COUNTY, TX

(UNINCORPORATED AREAS)

FLOOD INSURANCE ZONE DATA

OSO CREEK TRIBUTARY NO. 6-OSO CREEK TRIBUTARY NO. 14-
DITCH A-DITCH B-DITCH BN-DITCH C

FLOODING SOURCE	PANEL[1]	ELEVATION DIFFERENCE[2] BETWEEN 1% (100-YEAR) FLOOD AND			FLOOD HAZARD FACTOR	ZONE	BASE FLOOD ELEVATION (FEET NGVD)[3]
		10% (10-YEAR)	2% (50-YEAR)	0.2% (500-YEAR)			
Ditch F							
Reach 1	275	-0.6	-0.2	+0.6	050	A1	Varies
West Oso Creek							
Reach 1	485,500	*	*	*	010	A2	Varies
San Fernando Creek							
Reach 1	425,600	*	*	*	020	A4	Varies
Pintas Creek							
Reach 1	425,450	*	*	*	015	A3	Varies
Petronila Creek							
Reach 1	250,450, 475,625	*	*	*	020	A4	Varies
Yakey Swale							
Reach 1	250	*	*	*	020	A4	Varies
Reach 2	225,250	*	*	*	010	A2	Varies
Aqua Dulce Creek							
Reach 1	225,250	*	*	*	020	A4	Varies
Banquete Creek							
Reach 1	250	*	*	*	020	A4	Varies

[1] Flood Insurance Rate Map Panel [2] Weighted Average [3] Rounded to Nearest Foot

*Refer to Nueces County Flood Insurance Studies of 9-27-72 and 9-3-76

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TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

NUECES COUNTY, TX

(UNINCORPORATED AREAS)

FLOOD INSURANCE ZONE DATA

DITCH F-WEST OSO CREEK-SAN FERNANDO CREEK-PINTAS CREEK-PETRONILA CREEK-YAKEY SWALE-AGUA DULCE CREEK-BANQUETE CREEK

FLOODING SOURCE	PANEL[1]	ELEVATION DIFFERENCE[2] BETWEEN 1% (100-YEAR) FLOOD AND			FLOOD HAZARD FACTOR	ZONE	BASE FLOOD ELEVATION (FEET NGVD)[3]
		10% (10-YEAR)	2% (50-YEAR)	0.2% (500-YEAR)			
Carretta Creek							
Reach 1	600	-2.5	-0.7	+1.6	025	A5	Varies
Reach 2	600	-2.0	-0.5	+1.3	020	A4	Varies
Reach 3	600	*	*	*	015	A3	Varies
North Carretta Creek							
Reach 1	600	-1.2	-0.3	+0.8	010	A2	Varies
Reach 2	600	-1.5	-0.5	+1.0	015	A3	Varies
Flow Path No. 1							
Reach 1	250	*	*	*	005	A1	Varies
Ponding Area No. 1							
Reach 1	675	*	*	*	005	A1	Varies
Shallow Ponding Area	450	**	**	**	**	AH	65
Shallow Flooding Area	275	**	**	**	**	AH	Varies

[1] Flood Insurance Rate Map Panel [2] Weighted Average [3] Rounded to Nearest Foot

*Refer to Nueces County Flood Insurance Studies of 9-27-72 and 9-3-76

**Not determined for shallow flooding areas

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

NUECES COUNTY, TX

(UNINCORPORATED AREAS)

FLOOD INSURANCE ZONE DATA

CARRETTA CREEK-NORTH CARRETTA CREEK-FLOW PATH NO. 1-PONDING AREA NO. 1-SHALLOW FLOODING AREA

FLOODING SOURCE	TRANSECTS	PANELS	STILLWATER ELEVATIONS				FLOOD HAZARD FACTOR[1]	ZONE[1]	BASE FLOOD ELEVATION[2] (FEET NGVD)
			10-YR	50-YR	100-YR	500-YR			
Laguna Madre	N/A**	675,680	3.2	6.6	8.8	10.0	060	A12	9
	1	680,685	0.90	7.97	9.82	12.41	140	V24	13-12
			0.90	7.97	9.82	12.41	100	A20	11-10
	2	680,681,685	0.90	7.97	9.82	12.41	140	V24	13-12
			0.90	7.97	9.82	12.41	100	A20	11-10
Gulf of Mexico/ Laguna Madre	3	540,563,564, 685,705	2.36	*	7.03	*	070	V14	11-9
			2.36	*	7.03	*	065	A13	9-8
			1.69	7.81	9.16	12.13	065	A13[3]	11-10
			1.63	7.79	9.53	12.06	120	V22	11-12
			1.63	7.79	9.53	12.06	090	A18	11-10
	4	564,565	2.36	*	7.03	*	070	V14	11-9
			2.36	*	7.03	*	065	A13	9-8
			1.69	7.81	9.16	12.13	065	A13[3]	11-10
			1.83	7.50	8.66	11.56	120	V22[3]	11
Corpus Christi Bay	5	563,564	2.57	*	7.49	*	090	A18[3]	10
Nueces Bay	6	304,308,309, 315	2.58	10.23	11.18	15.58	090	A18[3]	12
	7	284,303,304, 315	2.78	11.78	13.38	17.55	110	A21[3]	13

1-Includes the effects of Wave Action, where applicable.

2-Due to map scale limitations, Base Flood Elevations (BFEs) shown on the Flood Insurance Rate Map may represent average elevation for the zone depicted.

3-Weighted average value

*These elevations are not available

**Taken from Kleburg County Flood Insurance Study

TABLE 5

FEDERAL EMERGENCY MANAGEMENT AGENCY

NUECES COUNTY, TX

(UNINCORPORATED AREAS)

COASTAL FLOOD INSURANCE ZONE DATA

LAGUNA MADRE-GULF OF MEXICO/LAGUNA MADRE-CORPUS CHRISTI BAY-NUECES BAY

FLOODING SOURCE	TRANSECTS	PANELS	STILLWATER ELEVATIONS				FLOOD HAZARD FACTOR[1]	ZONE[1]	BASE FLOOD ELEVATION[2] (FEET NGVD)
			10-YR	50-YR	100-YR	500-YR			
Nueces Bay (cont.)	8	88,280,281,282, 283,284,303,305	1.87	12.21	13.97	17.94	140	A24[3]	14
	9	282,303,305	2.48	11.18	12.85	16.60	110	V21[3]	15-16
Oso Bay	N/A	520,540,660	5.06	10.87	12.00	14.99	065	A13	12-13
Oso Bay/Oso Creek	N/A	520	8.2	12.6	13.7	17.0	055	A11	13-15
Oso Bay /Oso Creek Tributary No. 5	N/A	520	11.6	13.0	14.0	15.2	025	A5	13-15

[1] Includes the effects of Wave Action, where applicable.

[2] Due to map scale limitations, Base Flood Elevations (BFEs) shown on the Flood Insurance Rate Map may represent average elevation for the zone depicted.

[3] Weighted average value

TABLE 5

FEDERAL EMERGENCY MANAGEMENT AGENCY

NUECES COUNTY, TX

(UNINCORPORATED AREAS)

COASTAL FLOOD INSURANCE ZONE DATA

NUECES BAY- OSO BAY-OSO BAY/OSO CREEK-
OSO BAY/OSO CREEK TRIBUTARY NO. 5

7.0 LOCATION OF DATA

Survey, hydrologic, hydraulic, and other pertinent data used in this study can be obtained by contacting the National and Technological Hazards Division, Federal Emergency Management Agency, Federal Center, Denton, Texas 76201.

8.0 BIBLIOGRAPHY AND REFERENCES

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TEXT REVISIONS
NUECES COUNTY, TEXAS

9.0 REVISION DESCRIPTION

9.1 Purpose

The purpose of this revision is to incorporate new and/or revised data into the currently effective Flood Insurance Study for unincorporated areas of Nueces County, Texas. This Revision Description is intended to provide updated information which aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973.

9.2 Acknowledgments

The hydraulic analysis for this revision to Oso Creek was performed by Urban Engineering and was completed in July 1985. The Federal Emergency Management Agency (FEMA) reviewed and accepted these data for purposes of this revision.

9.3 Scope

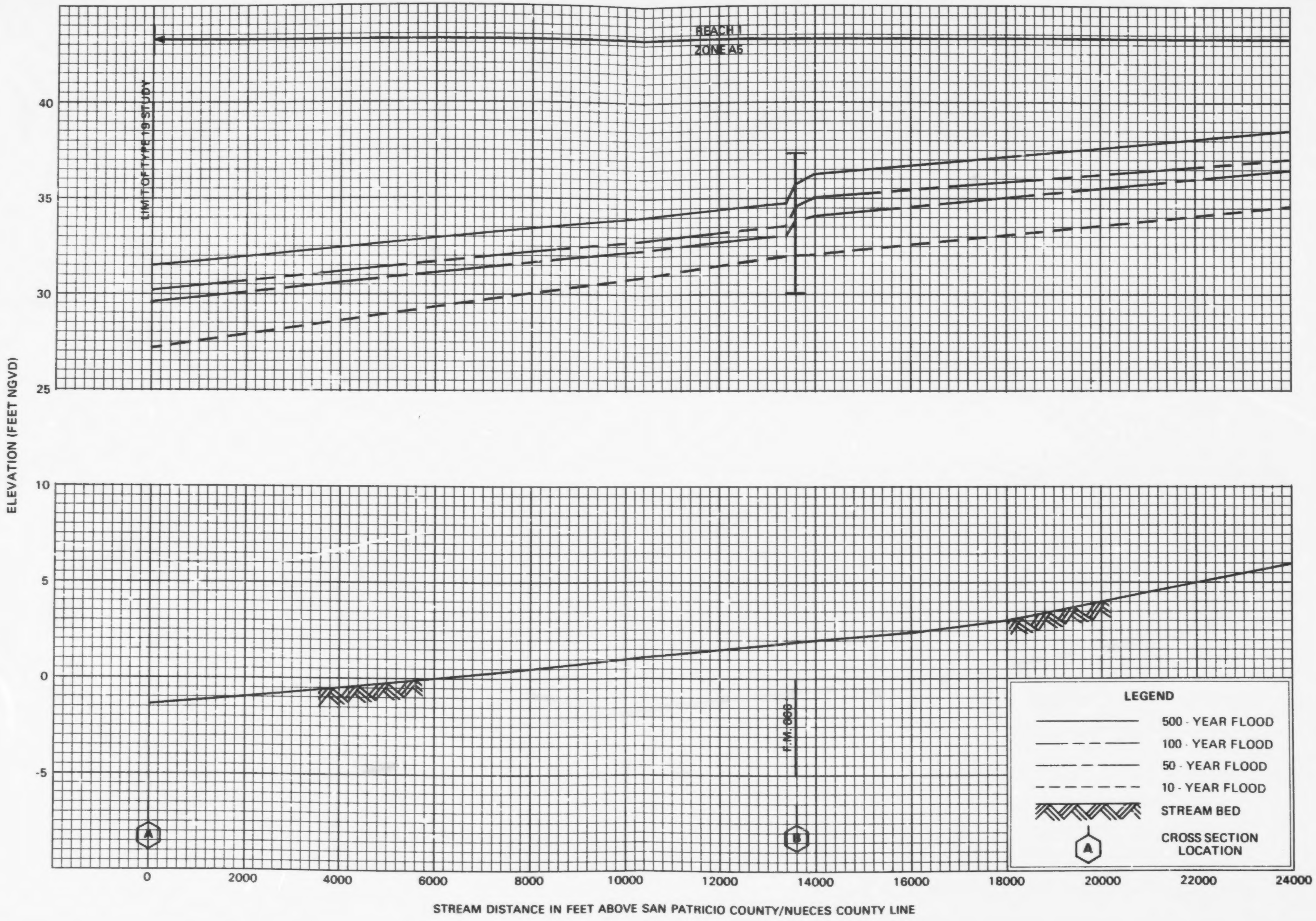
This revision incorporates the portion of Oso Creek from FM 2444 to State Route 286. The backwater elevations for Oso Creek were revised on Oso Creek Tributary No. 6.

9.4 Hydrologic and Hydraulic Analyses

The revised water-surface elevations for Oso Creek and Oso Creek Tributary No. 6 are detailed on Flood Profiles 05P, 06P, and 09P.

9.5 Floodways

The revised floodway widths and water-surface elevations for Oso Creek and Oso Creek Tributary No. 6 are described in the Floodway Data Tables.



FEDERAL EMERGENCY MANAGEMENT AGENCY

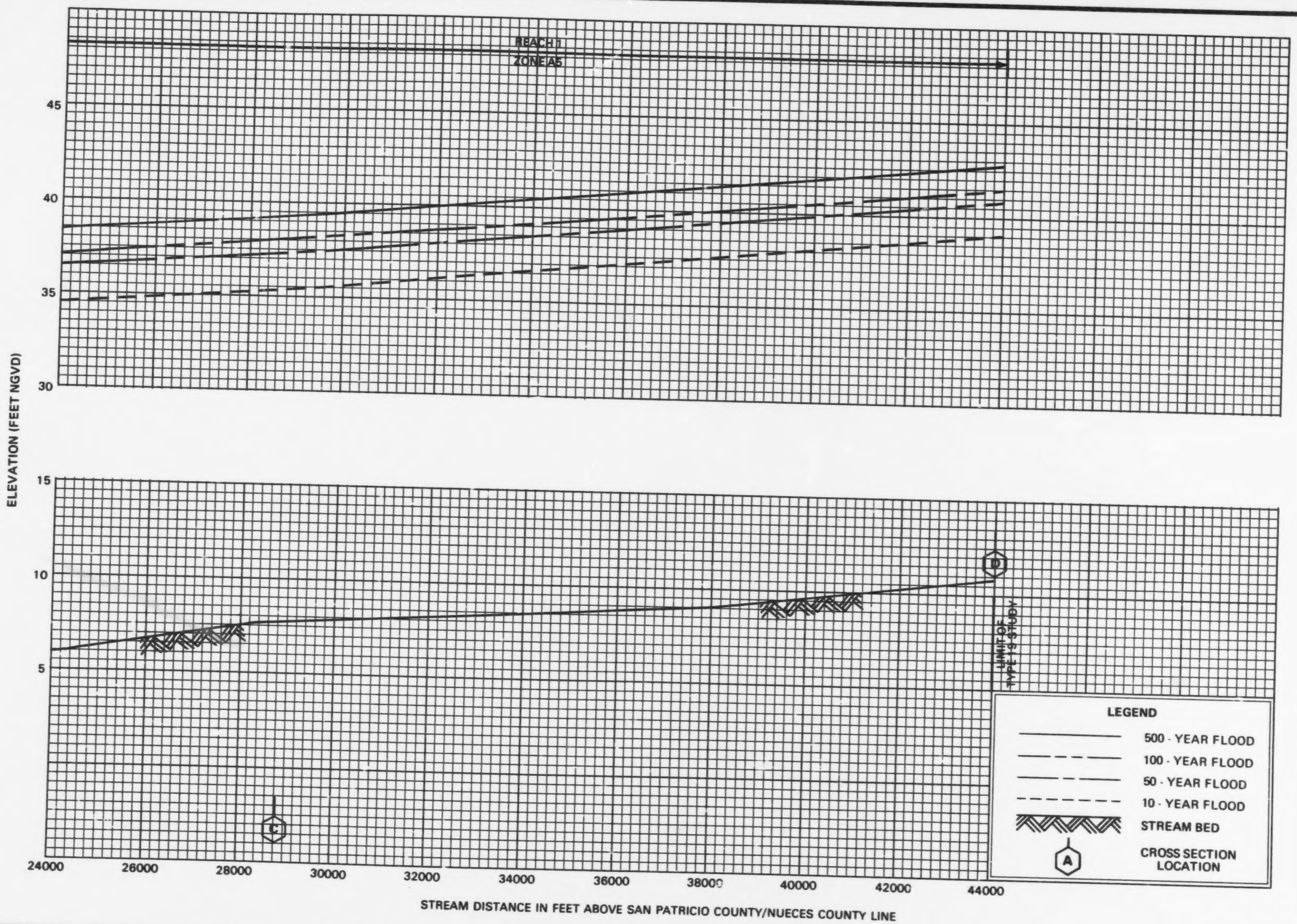
NUECES COUNTY, TX

(UNINCORPORATED AREAS)

FLOOD PROFILES

NUECES RIVER (PART 1)

01P



FLOOD PROFILES

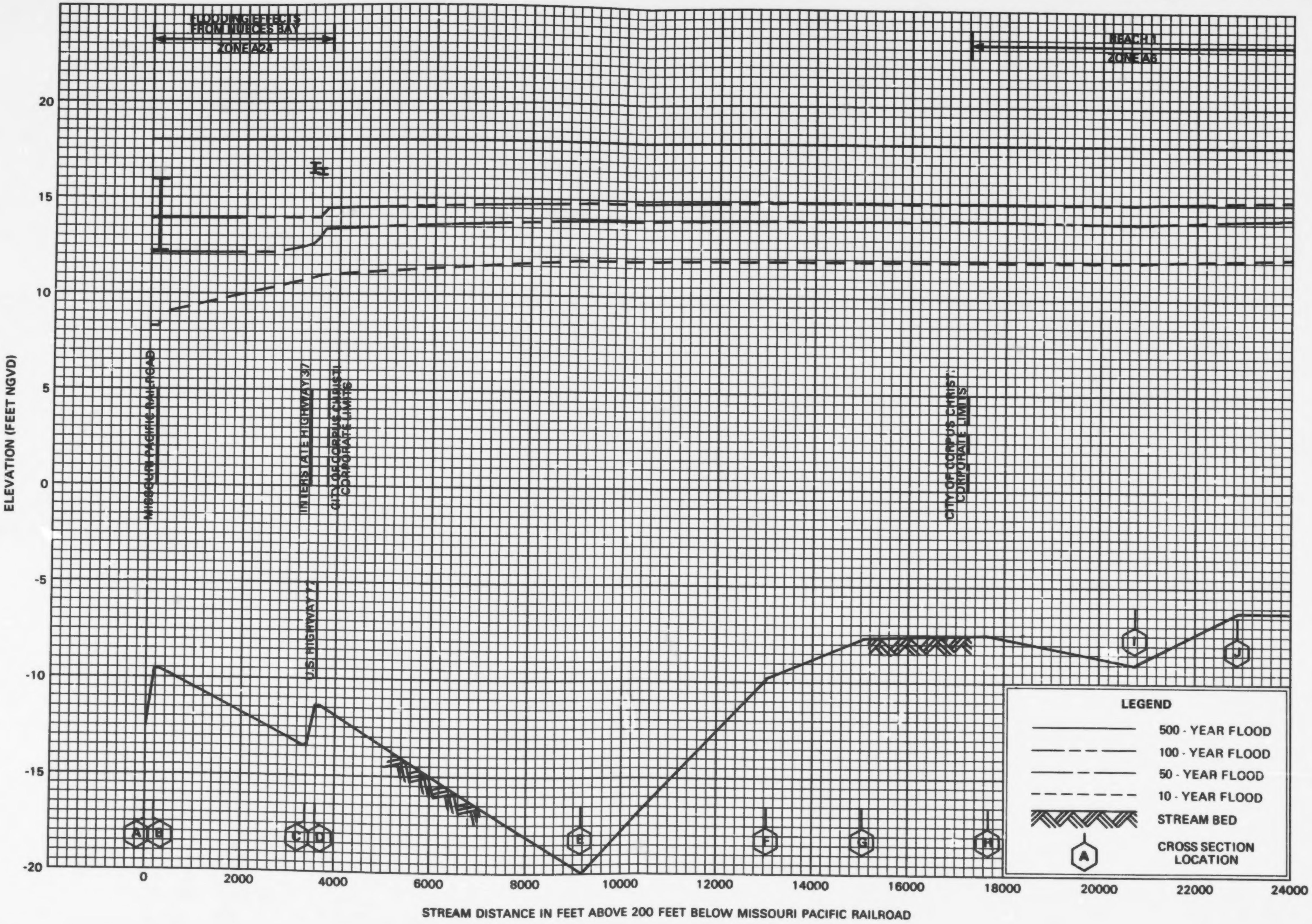
NUECES RIVER (PART 1)

FEDERAL EMERGENCY MANAGEMENT AGENCY

NUECES COUNTY, TX

(UNINCORPORATED AREAS)

02P



FLOOD PROFILES

NUECES RIVER (PART 2)

FEDERAL EMERGENCY MANAGEMENT AGENCY

NUECES COUNTY, TX
(UNINCORPORATED AREAS)

03P

44

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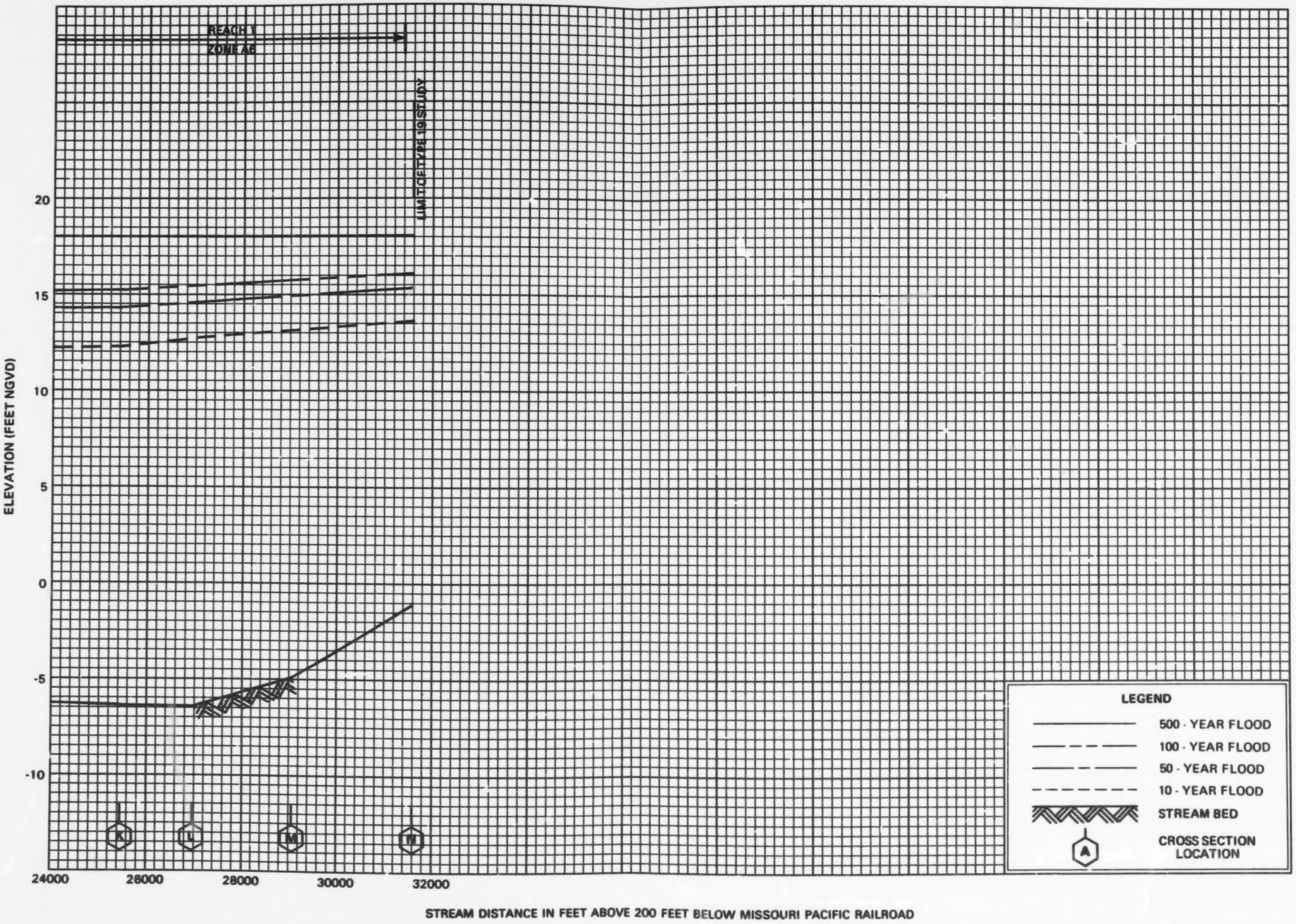


FLOOD PROFILES

NUECES RIVER (PART 2)

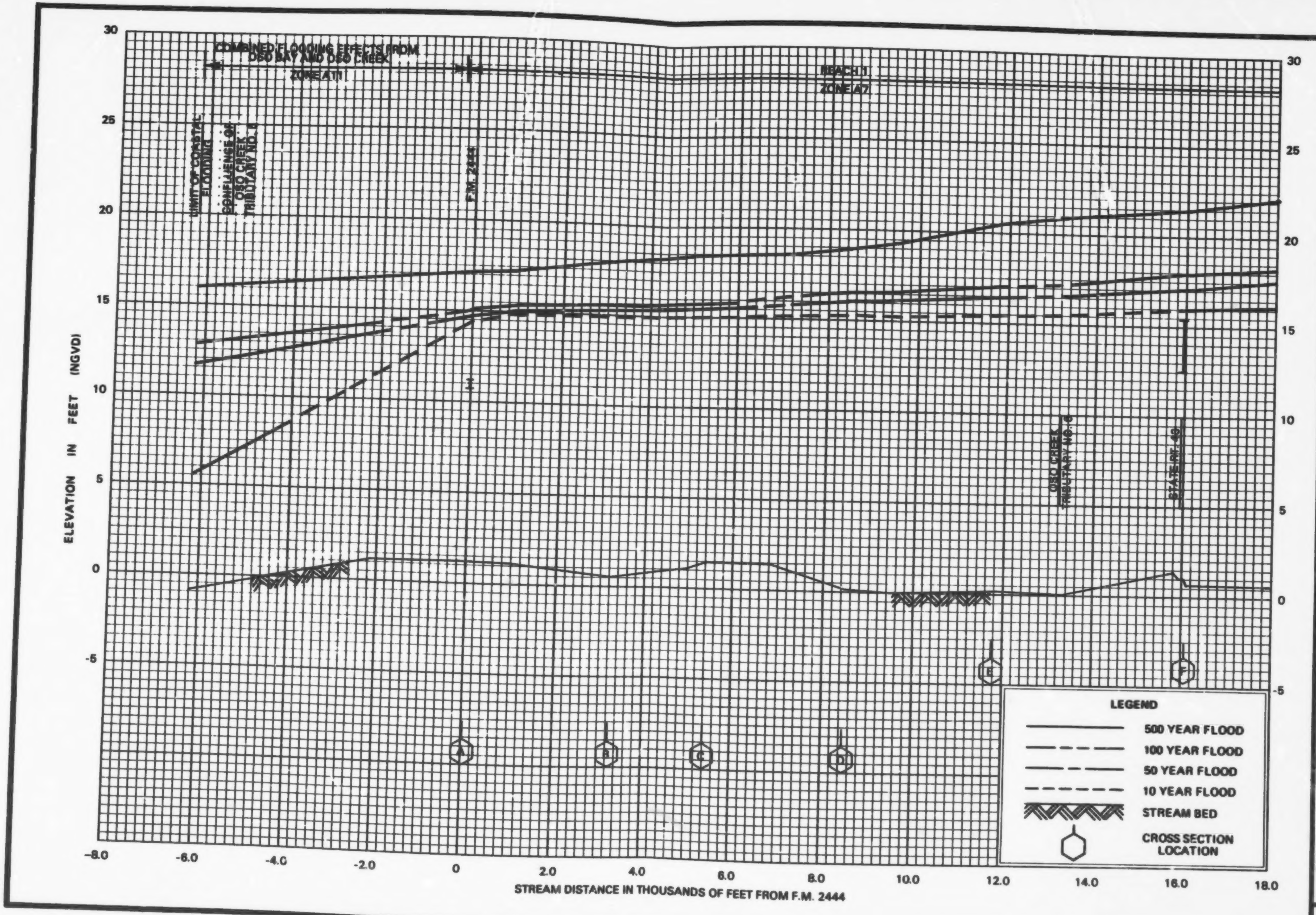
FEDERAL EMERGENCY MANAGEMENT AGENCY

NUECES COUNTY, TX

(UNINCORPORATED AREAS)

04P

45



FLOOD PROFILES

OSO CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

NUECES COUNTY, TX

(UNINCORPORATED AREAS)

05P

46

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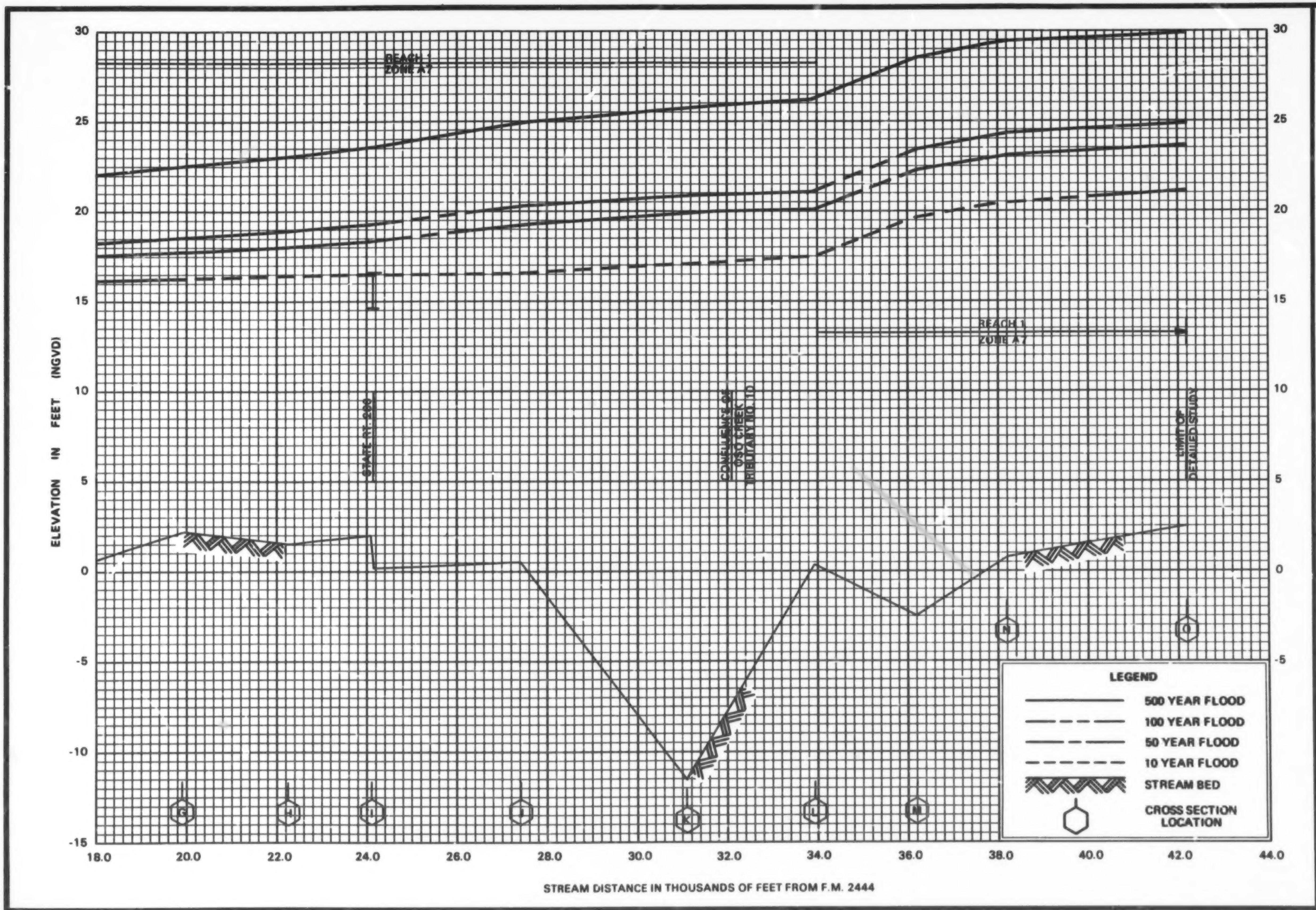

FLOOD PROFILES

OSO CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

NUECES COUNTY, TX
(UNINCORPORATED AREAS)

06P

47

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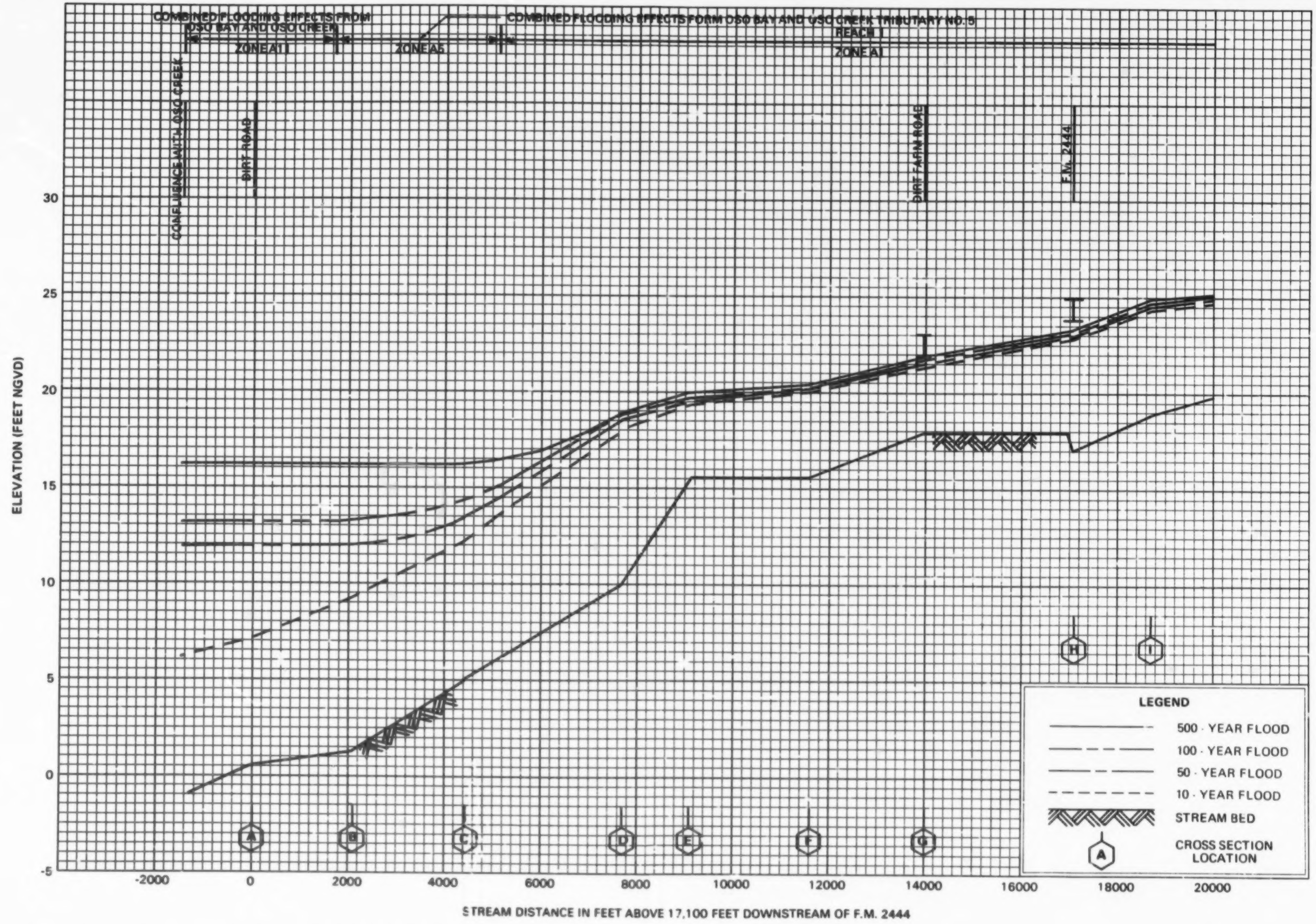


FLOOD PROFILES

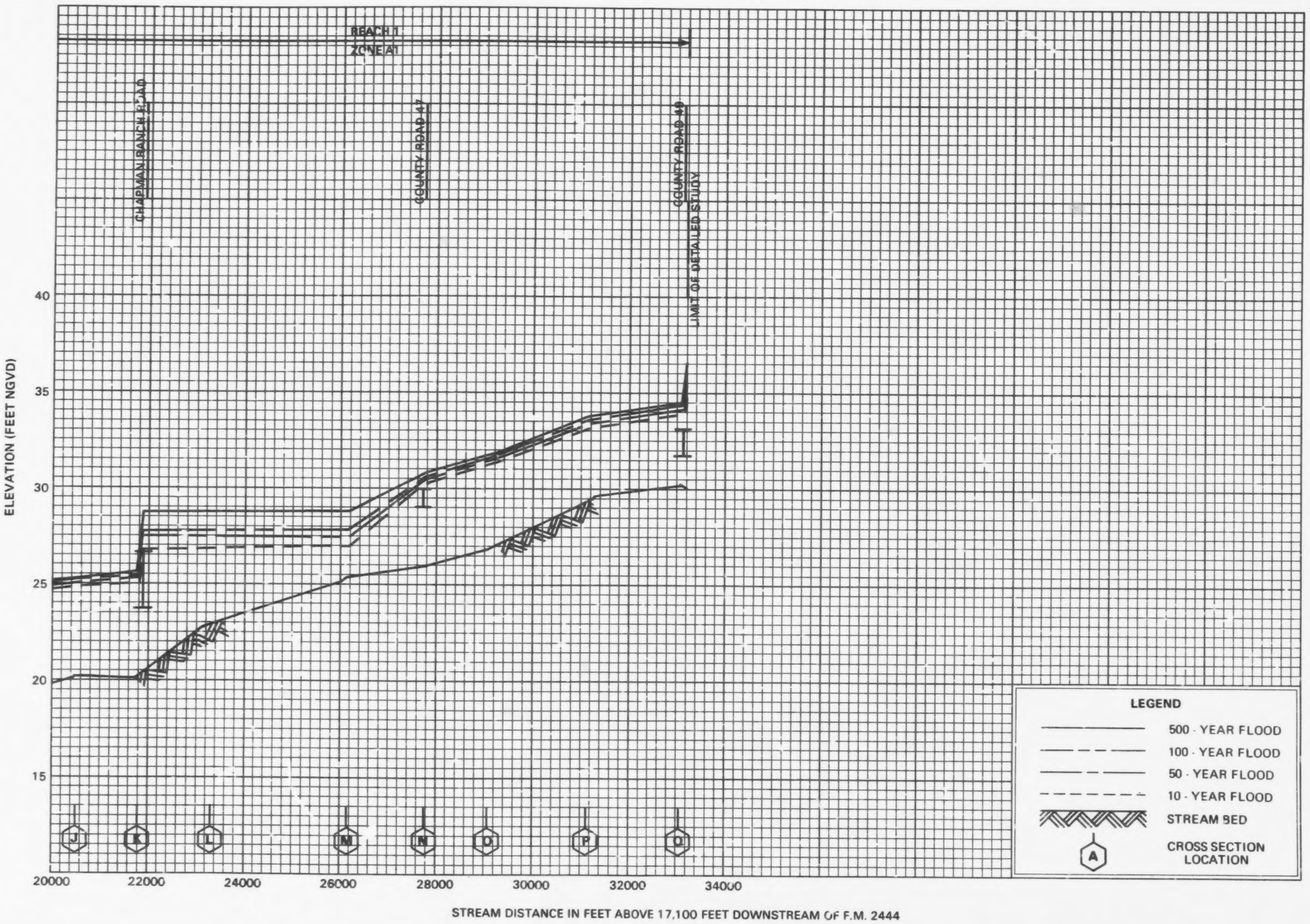
OSO CREEK TRIBUTARY NO. 5

FEDERAL EMERGENCY MANAGEMENT AGENCY

NUECES COUNTY, TX
(UNINCORPORATED AREAS)

07P

48



FLOOD PROFILES

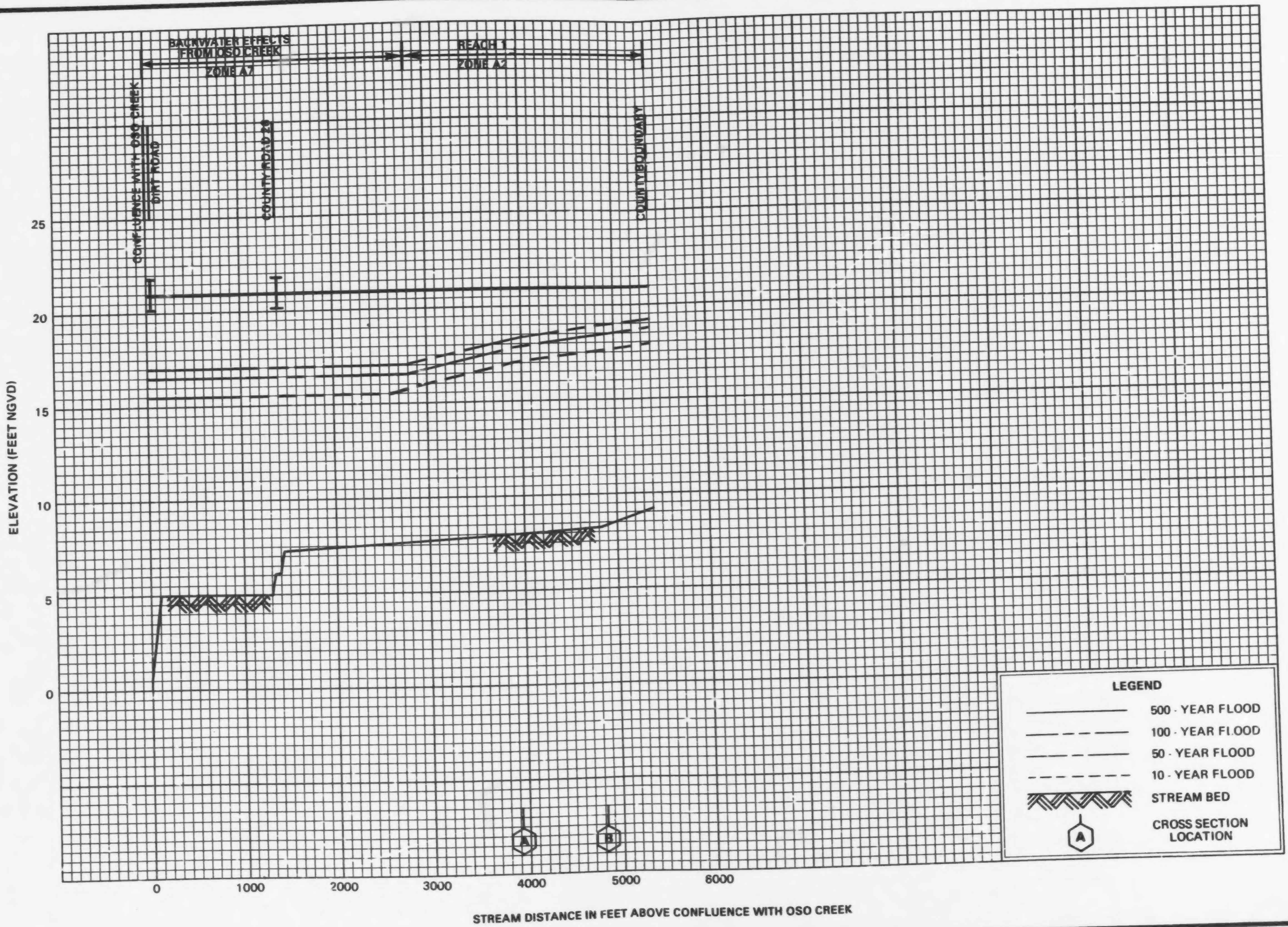
OSO CREEK TRIBUTARY NO. 5

FEDERAL EMERGENCY MANAGEMENT AGENCY

NUECES COUNTY, TX

(UNINCORPORATED AREAS)

08P



FLOOD PROFILES

OSO CREEK TRIBUTARY NO. 6

FEDERAL EMERGENCY MANAGEMENT AGENCY

NUECES COUNTY, TX
(UNINCORPORATED AREAS)

09P

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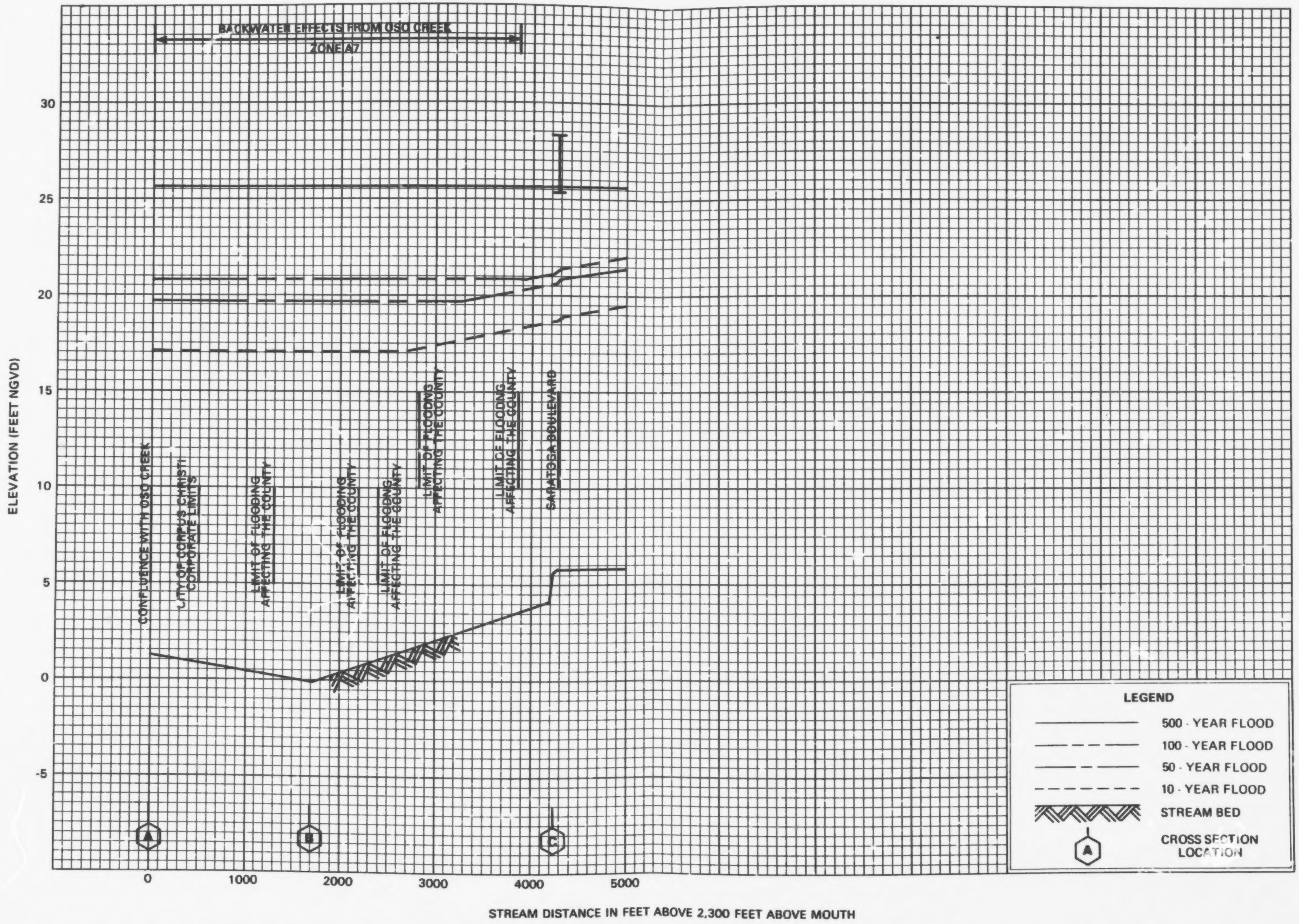

FLOOD PROFILES

OSO CREEK TRIBUTARY NO. 10

FEDERAL EMERGENCY MANAGEMENT AGENCY

NUECES COUNTY, TX
(UNINCORPORATED AREAS)

10P

61

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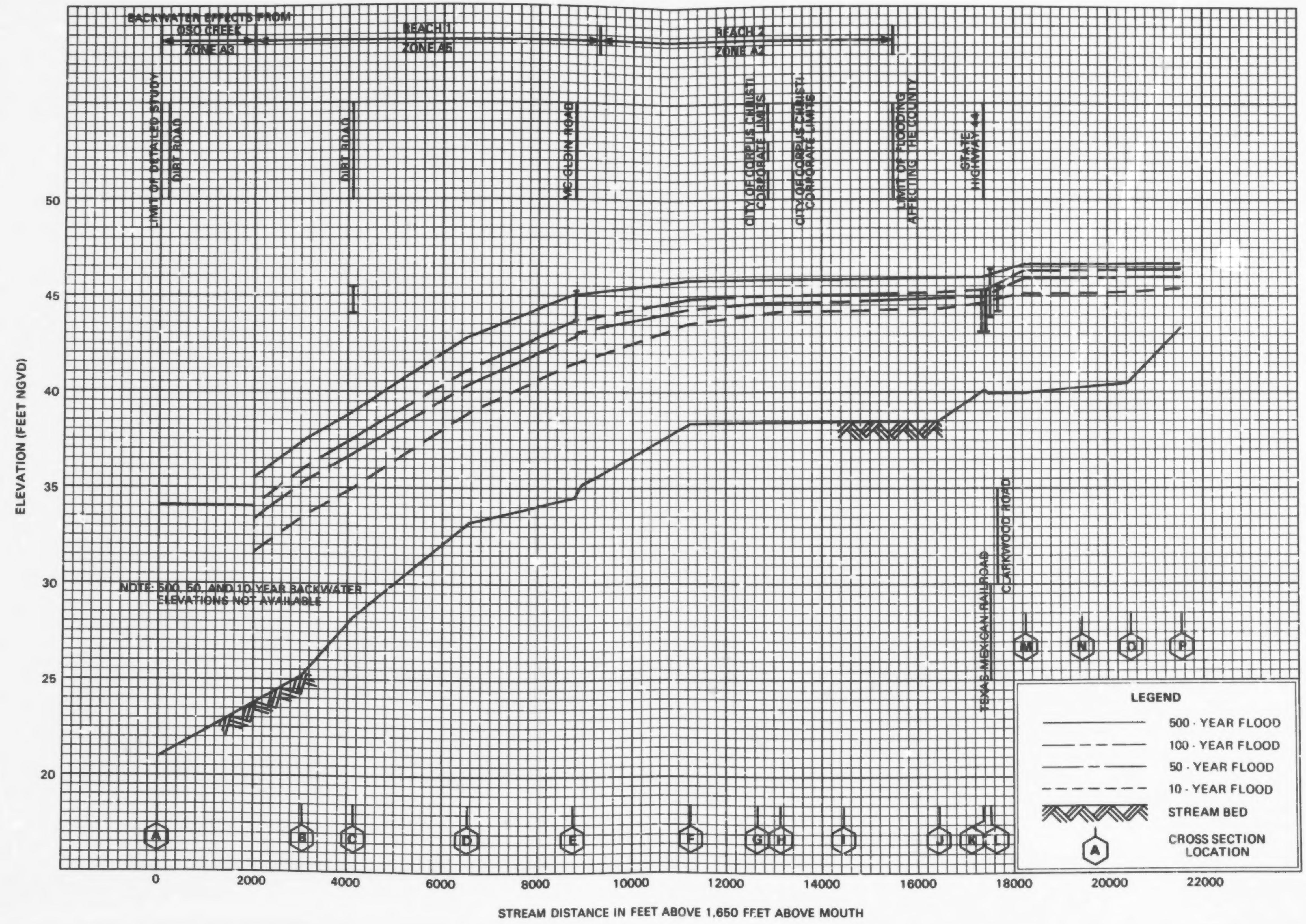


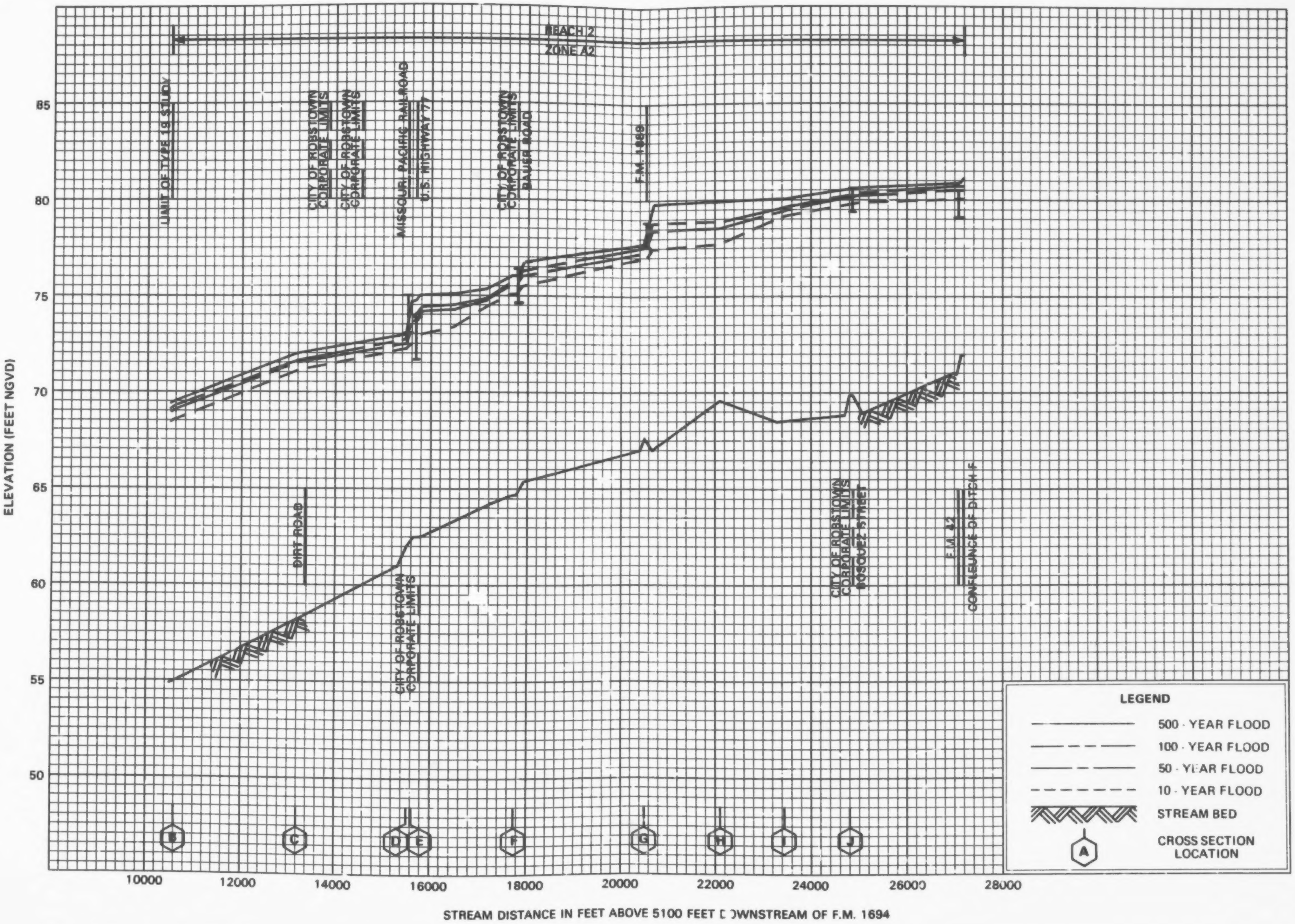
FLOOD PROFILES

OSO CREEK TRIBUTARY NO. 14

FEDERAL EMERGENCY MANAGEMENT AGENCY

NUECES COUNTY, TX

(UNINCORPORATED AREAS)



FLOOD PROFILES

DITCH A

FEDERAL EMERGENCY MANAGEMENT AGENCY

NUECES COUNTY, TX

(UNINCORPORATED AREAS)

12P

83

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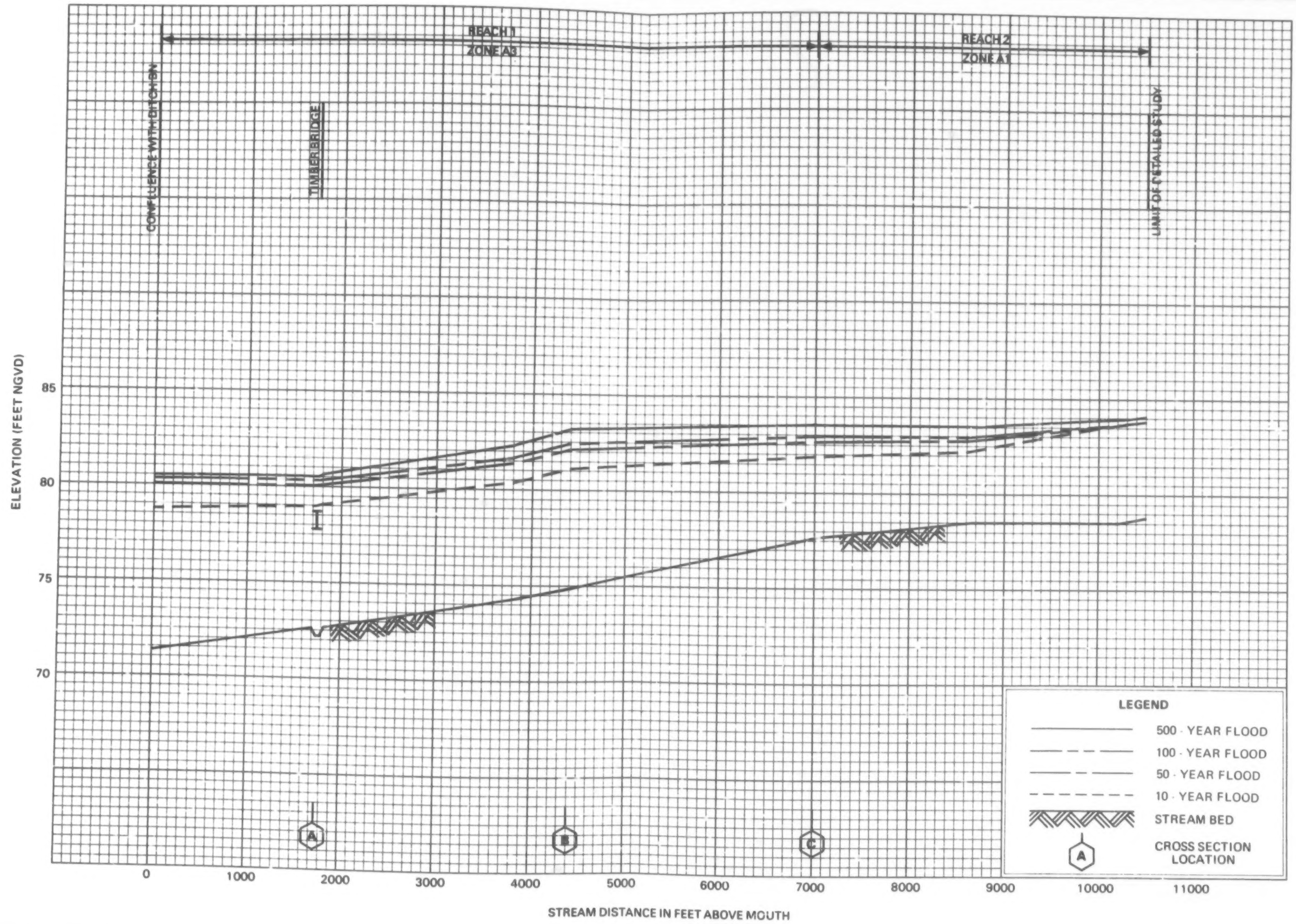


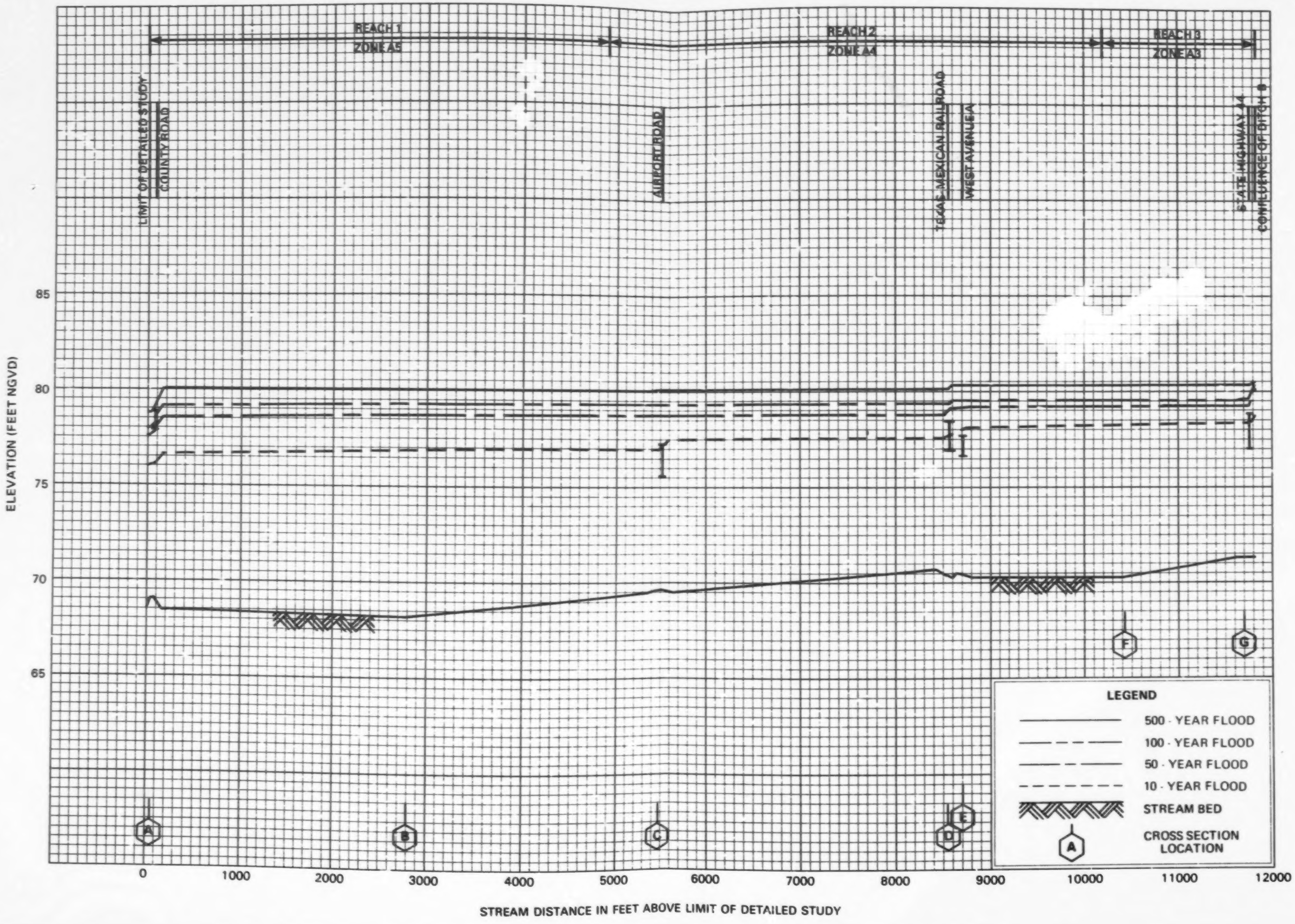
FLOOD PROFILES

DITCH B

FEDERAL EMERGENCY MANAGEMENT AGENCY

NUECES COUNTY, TX

(UNINCORPORATED AREAS)



FLOOD PROFILES

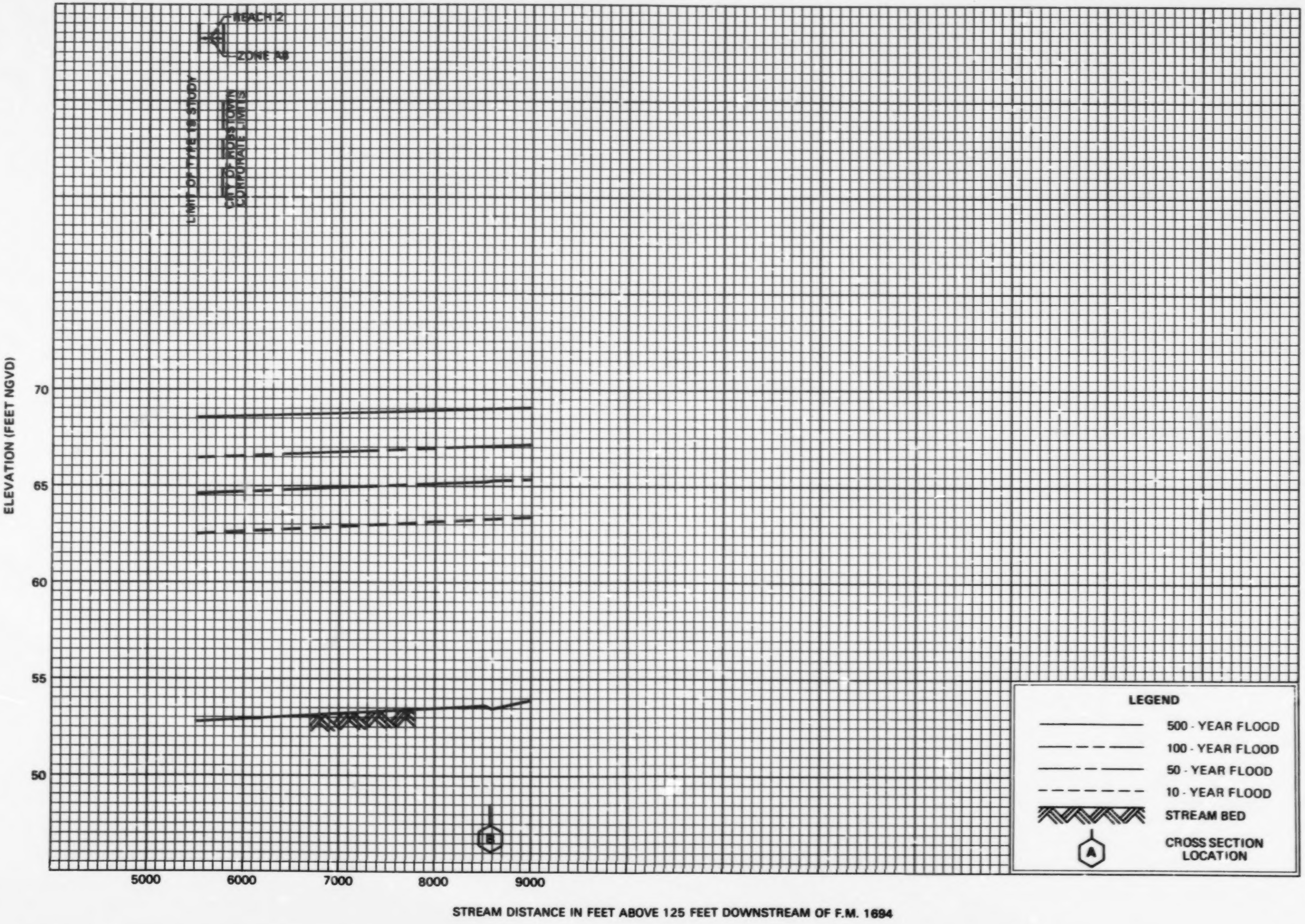
DITCH BN

FEDERAL EMERGENCY MANAGEMENT AGENCY

NUECES COUNTY, TX

(UNINCORPORATED AREAS)

14P



FLOOD PROFILES

DITCH C

FEDERAL EMERGENCY MANAGEMENT AGENCY

NUECES COUNTY, TX

(UNINCORPORATED AREAS)

15P

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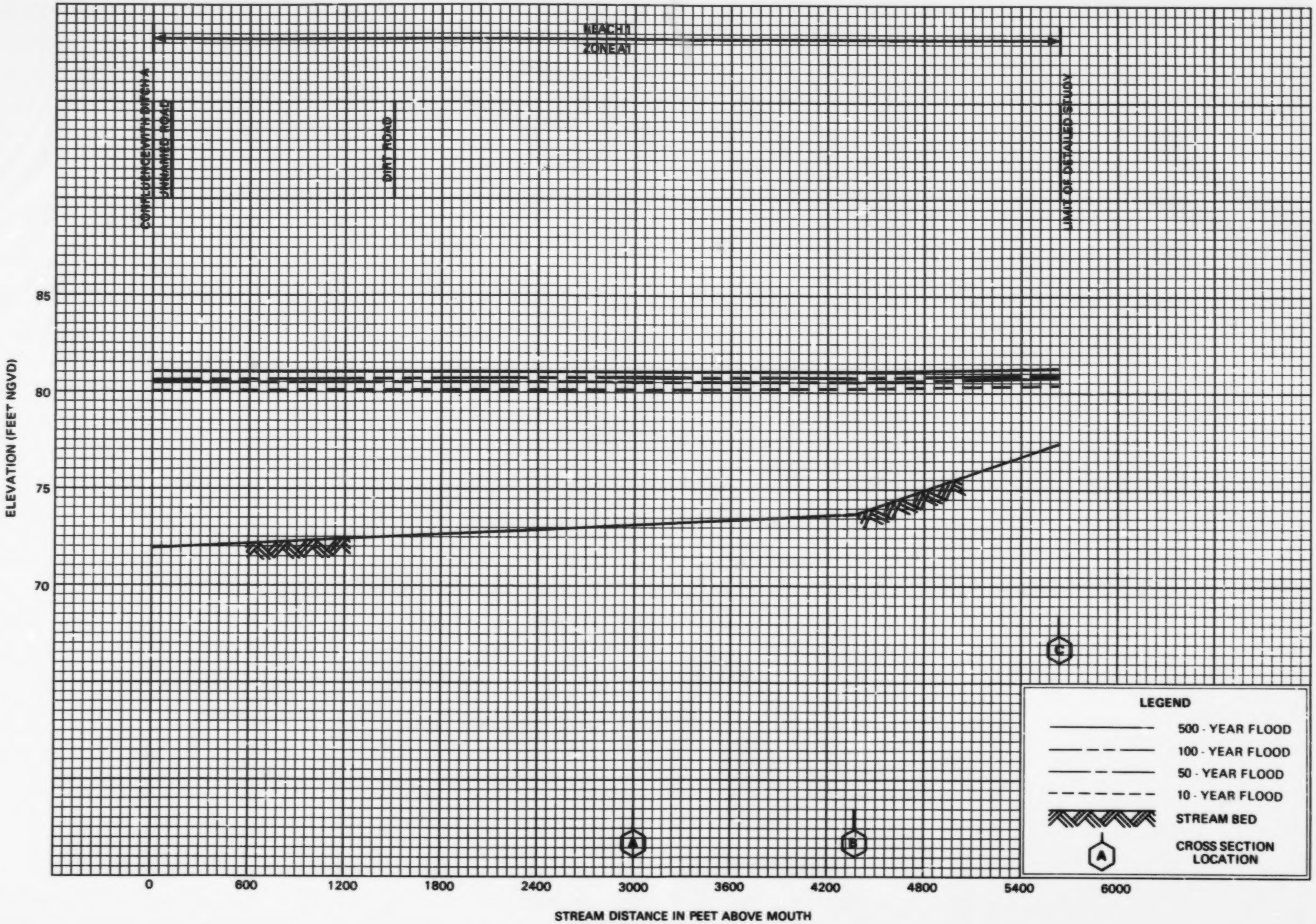


FLOOD PROFILES

DITCH F

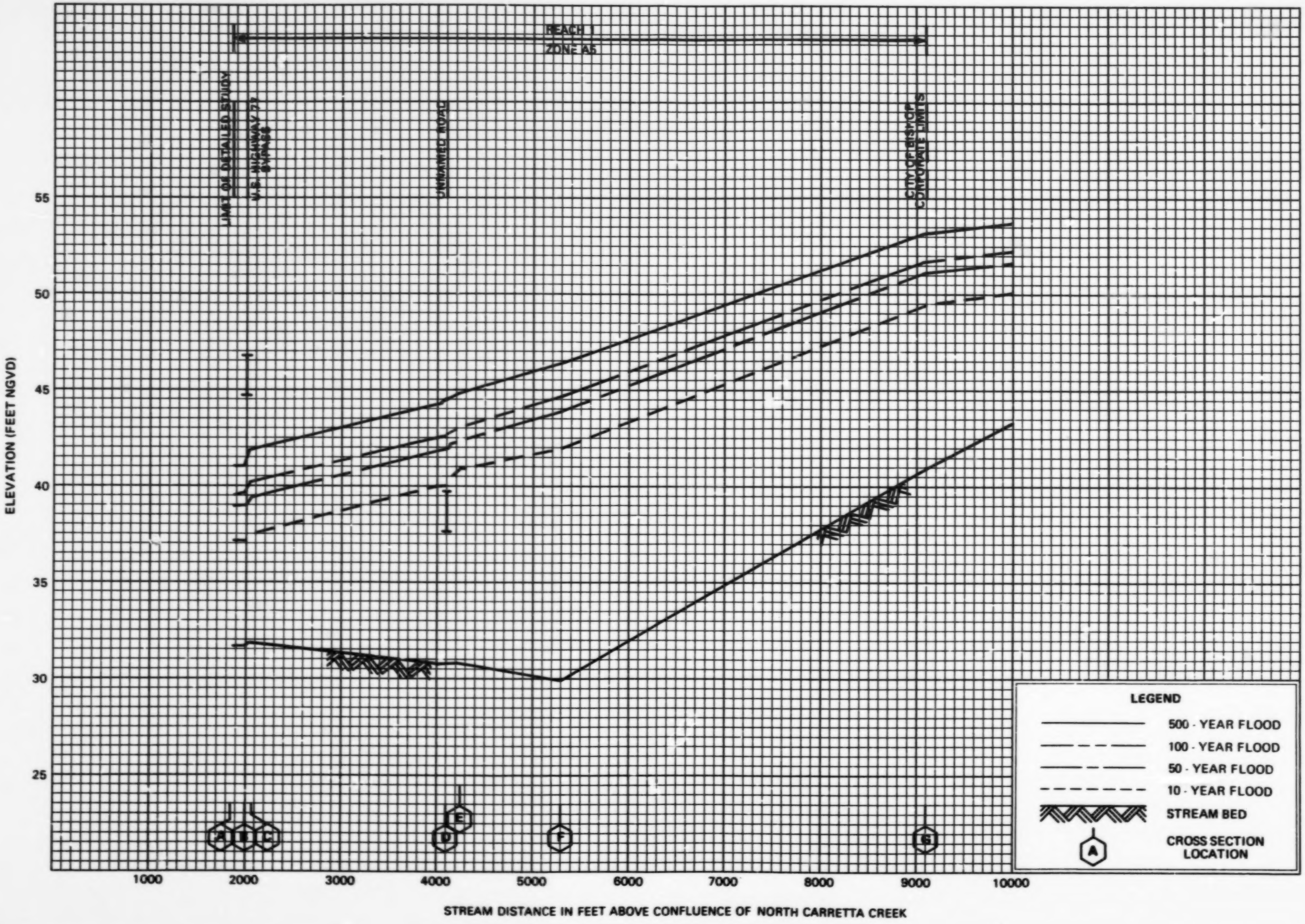
FEDERAL EMERGENCY MANAGEMENT AGENCY

NUECES COUNTY, TX

(UNINCORPORATED AREAS)

16P

BEST COPY AVAILABLE



FLOOD PROFILES

CARRETTA CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

NUECES COUNTY, TX
(UNINCORPORATED AREAS)

17P

58

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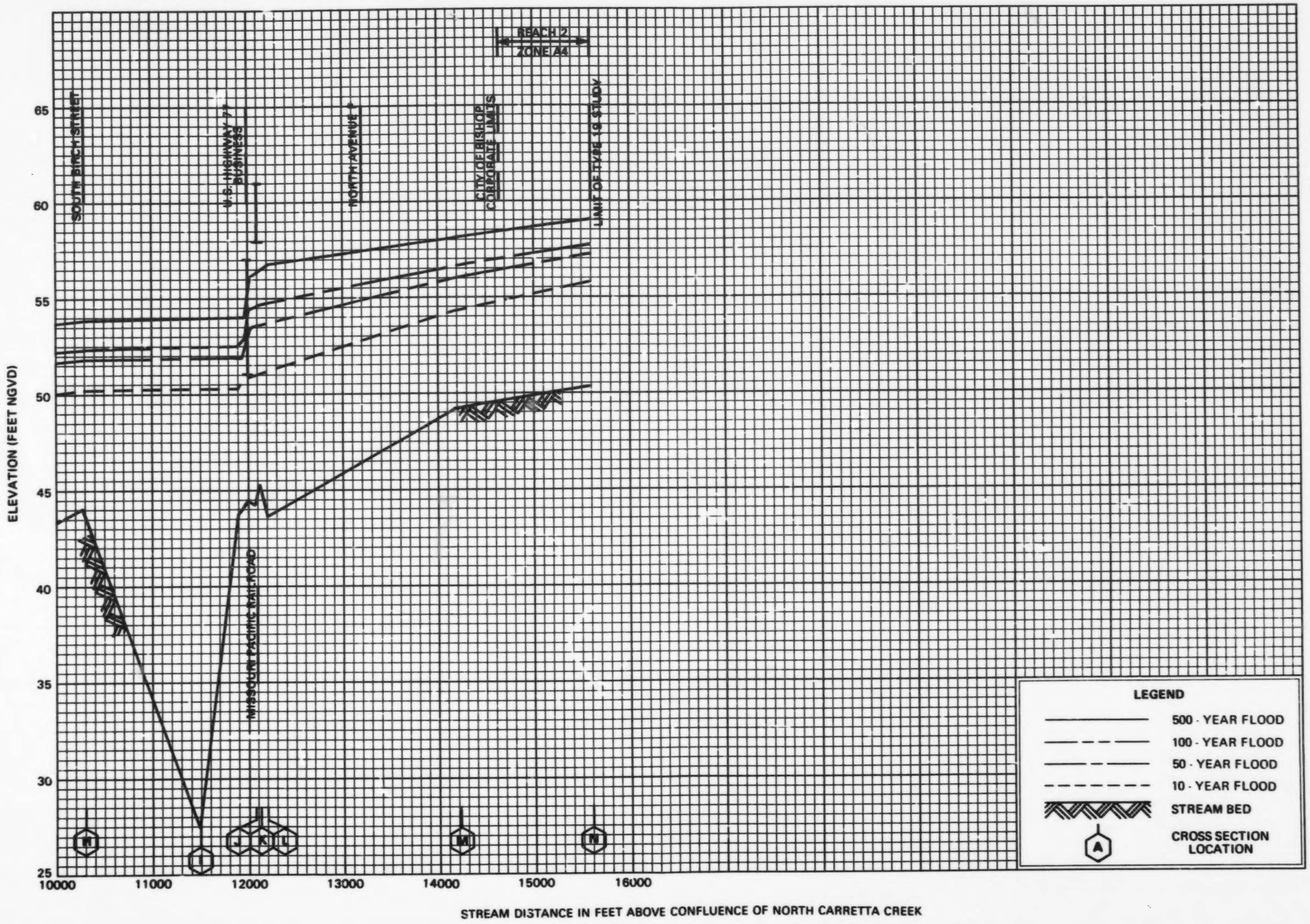

FLOOD PROFILES

CARRETTA CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

NUECES COUNTY, TX

(UNINCORPORATED AREAS)

18P

59

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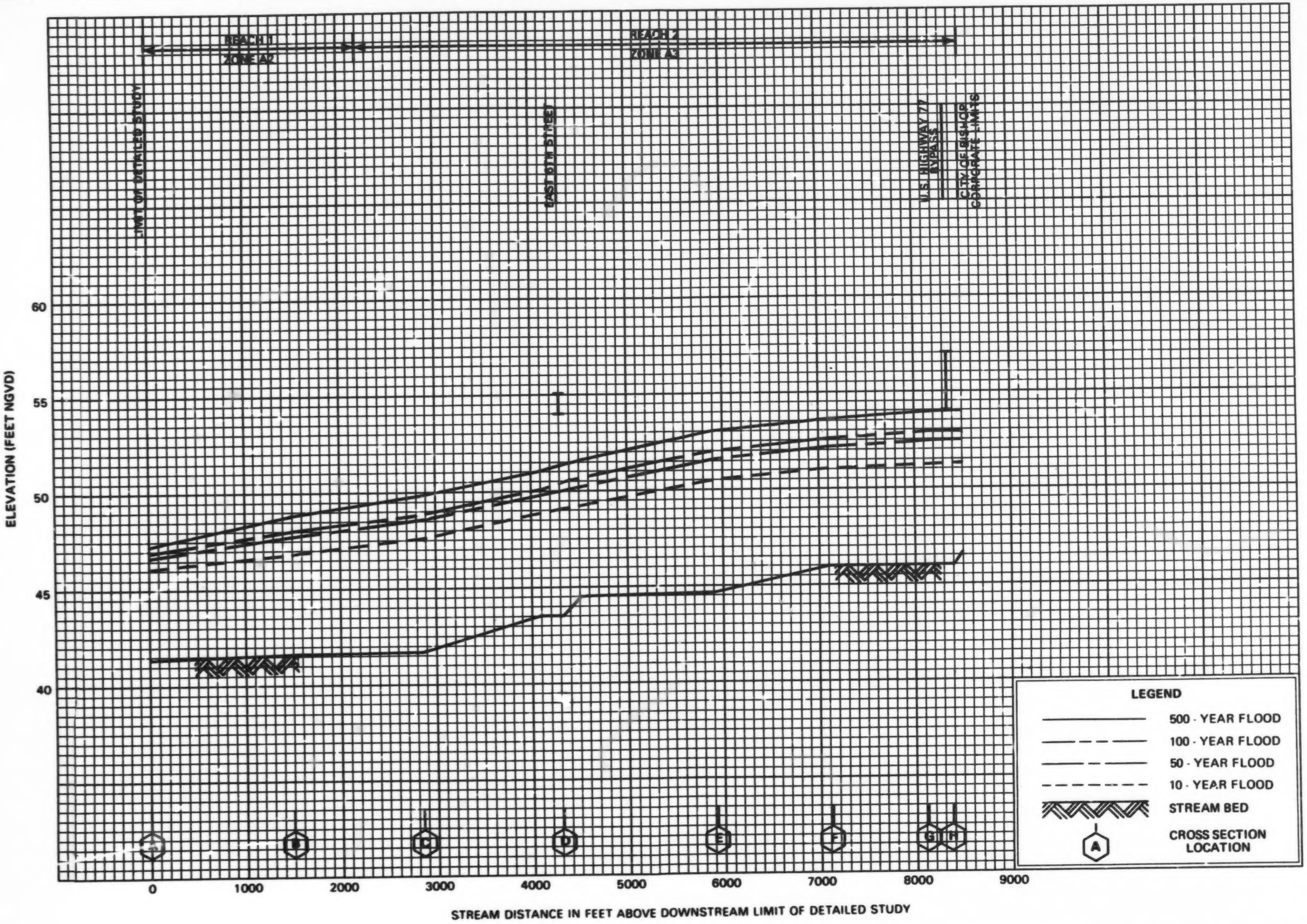

FLOOD PROFILES

NORTH CARRETTA CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

NUECES COUNTY, TX

(UNINCORPORATED AREAS)

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